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About Aluminium... 7

CHEMICAL PROPERTIES

This article is one of a series, written for the interest of students and others, outlining some of the main characteristics of the metal and its structural alloys.

THE durability, or resistance to deterioration by corrosive agencies, of aluminium and many of its alloys is exceptionally high, frequently enabling them to be used without surface protection of any sort, so saving both pre-treatment and maintenance costs. This is often of greater value than its more generally appreciated qualities, such as light weight.

Atmospheric Exposure

Aluminium does, in fact, combine readily with atmospheric oxygen, but the oxide, unlike those of iron or copper, forms as a continuous film, which is hard and very adherent. This stable layer of oxide seals the metal from further oxidation, reforming spontaneously when the surface is cut or abraded in air. Its thickness, as naturally formed, depends on the alloy and on the nature and duration of exposure, but is of the order of a hundred-thousandth of an inch. It is transparent or nearly so, becoming visible as a grey film when thickened by age, exposure, or heating. The metal is exposed to attack only when the surface film is broken and, by lack of oxygen, prevented from reforming.

The nature of the film, and the immunity of the metal, are influenced by the presence of alloying constituents, and some of the strong copper-bearing alloys, for instance, normally need some means of protection. However, the medium-strength alloys that are used for building, and for the majority of civil and mechanical engineering purposes, can generally be used without protection.

Particular attention must be given to alloy selection and conditions of use when the surroundings are industrial and the air may carry many kinds of pollution, some of them aggressive. Except in special cases, however, aluminium will generally outlast other metals and is increasingly used, for instance, on factory roofs in place of galvanized steel.

The aluminium-magnesium group of alloys is particularly resistant to sea and coastal atmospheres, and is used in ship and boat construction.

Exposure of the bare metal to any atmosphere must, after a period (perhaps of years) that will depend on the circumstances, impair its original lustre and smoothness, and, in severe conditions, surface deposits and slight pitting may appear. These changes are almost always superficial, and the appearance can be restored by cleaning.

Aggressive Conditions

Apart from direct attack by corrosive agents, such as alkaline or acidic fumes, or contact with damp cement or plaster, most instances of corrosion in aluminium alloy structures occur in places where air is excluded, often by entrapped moisture. Local corrosion may be the result of an electrochemical process, and when a film of liquid can act as an electrolyte, galvanic action is liable to occur between zones of unequal potential, as provided by dissimilar metals, different alloys of aluminium, or even the aluminium and its own alloying elements or impurities. Copper and nickel are particularly aggressive, iron less so.

Susceptibility of an alloy to corrosion is influenced by other internal factors besides its chemical composition, such as grain size, heat treatment history, and the stress to which the metal is subjected.

Food and Chemicals —

The aluminium employed for processing, packing, and cooking foods does not generally need protection, although for packing some products, cans may be lacquered. As the salts of aluminium are colourless, tasteless, and non-poisonous, there are no ill effects when strongly alkaline or acid foods dissolve minute amounts of the metal.

In the chemical industry, aluminium is extensively used, again generally unalloyed and sometimes of especially high purity. It offers considerable resistance to the action of most organic compounds and of such common chemicals as ammonia, sulphuretted hydrogen, and nitric and acetic acids; it is adversely affected by most alkalies, sulphuric and hydrochloric acids, chlorides, carbonates, and fluorides. Interaction is, however, dependent on the concentration and temperature of the reagent, and may be reduced or inhibited altogether by the presence of other substances. The whole subject is very complex and in the space available it is not possible to be more specific.

Protection

In any metallic structure, corners and crevices in which moisture can lodge should be avoided in design or effectively drained or sealed during construction.

Joints between aluminium and other metals can be insulated with a sealing paint (e.g. bitumen) or, preferably, with an inhibiting paint containing zinc chromate or barium chromate. Copper and copper alloy parts should not be used near aluminium structures where there is any possibility of interaction through a moisture layer. Steel bolts, nuts and other fittings are best galvanized or cadmium-plated. Where water-absorbent materials, such as wood and cloth, are in contact with an aluminium surface, it is advisable to interpose a coat of varnish or bituminous paint.

In severe conditions, or when an alloy of inferior corrosion-resistance is to be used, all-over painting may be necessary. Correctly applied, paints last particularly well on aluminium, and should the metal be attacked through damage to the paint, there is no tendency, as there is with rust, for the attack to spread under the paint film. A good base coat is provided by the modern priming paints containing an acid reagent that expends itself in lightly etching the metal. In the best work this is followed by an inhibitive zinc or barium chromate paint, before the finishing coats are applied. Bituminous paint is satisfactory where it is not exposed to sunlight.

Another form of surface protection for strong alloy sheet is applied by the metal fabricator, by 'cladding'. The alloy ingot is sandwiched between plates of high-purity aluminium, which the hot-rolling operations bond permanently to the faces. By whatever amount the gauge of the sheet is thereafter reduced, each skin will represent about 5% of the total thickness, insulating the strong alloy core from attack and giving electrolytic protection at cut edges and scratches. 'Alclad' sheet was first developed for aircraft construction.

A protective measure widely used in certain fields is the anodizing process, in which the natural oxide film is thickened electrolytically in an acid bath. The film, when freshly developed, is absorbent, and if desired it can be dyed for decoration, or filled with a grease or wax for added protection.

Plating of aluminium with other metals, such as chromium, is practised on a relatively small scale for decoration or to improve the wearing qualities of machine parts. The presence of the oxide film complicates deposition, but reliable methods of overcoming this have been developed.

It may be found that the Noral Data Sheet, which lists mechanical and physical properties of our alloys, is a useful appendix to these articles. We shall be pleased to send you a copy; please mention this journal when writing.

The eighth article will outline thermal characteristics of the metal.

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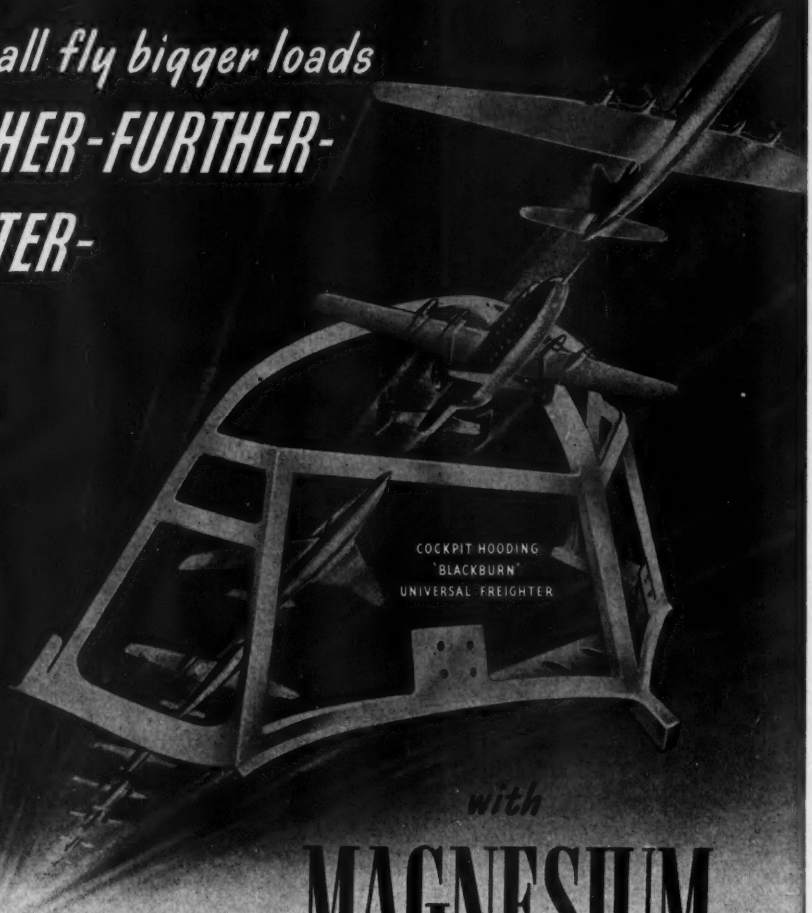

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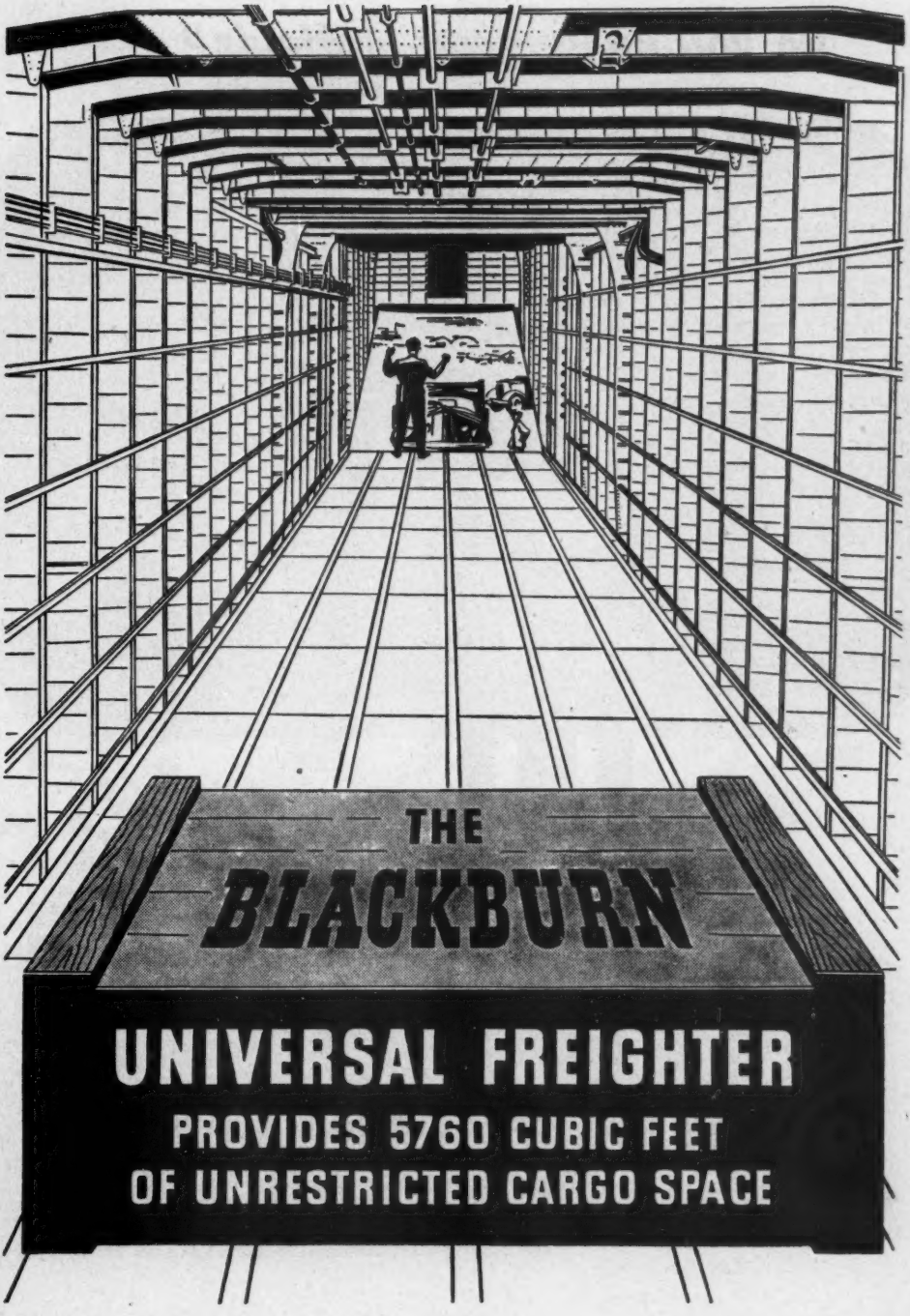
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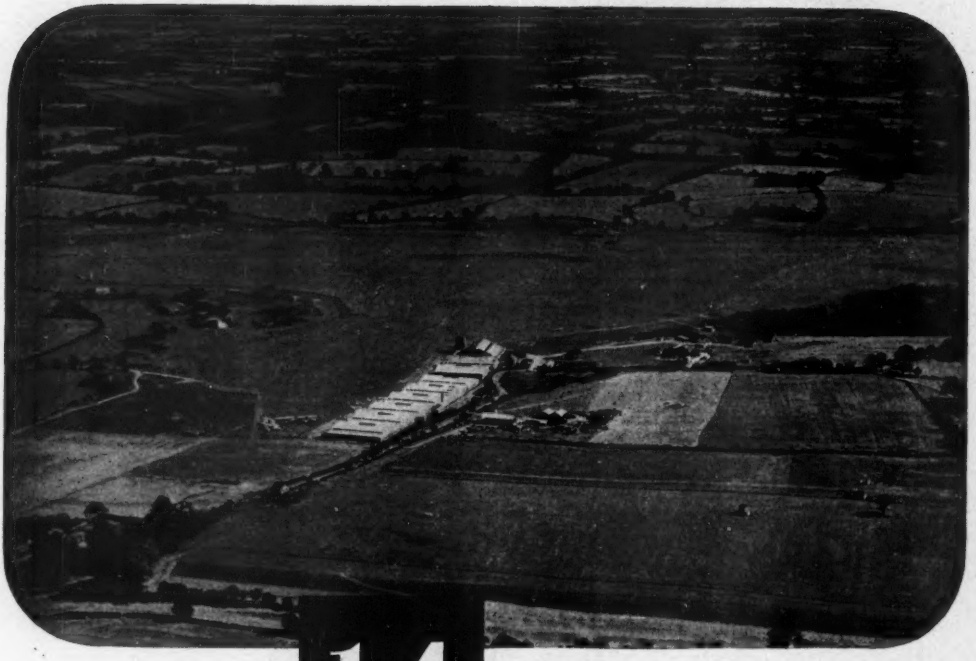

14

Recognise this airfield? It's No. 14 in this series of puzzle photographs. You'll find the answer below on the right. ★

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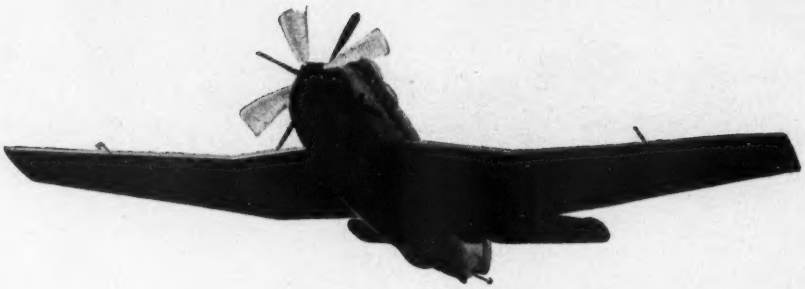

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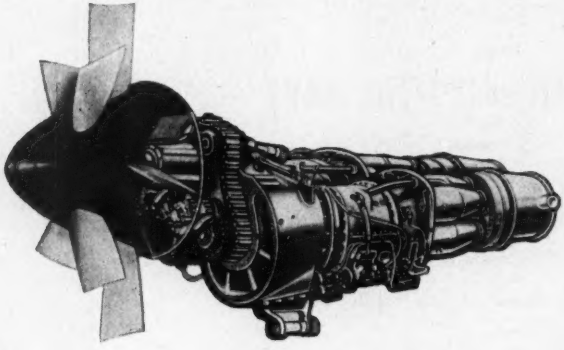

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Founded 1909

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Memories—And Expectations

TIME is a great healer, or, as Hippocrates said, healing is a matter of time. It is because of time's strange power to mellow our memories, preserving the pleasant things and fading those that were harsh and unwelcome, that we think always of the old days as good. Even the simplest things react to its friendly influence : can it be, for instance, that those childhood memories of summers with weeks of blazing sunshine reflect a finger-touch of time's healing hand? Certainly the days of aviation are no exception, and no one doubts that the old ones were good. Yet, perhaps because there is also something very vital and youthful about flying we never fail also to look forward to good and exciting days to come.

We are now on the eve of a great event in the aviation year. On September 11th the 1951 Exhibition and Display of the Society of British Aircraft Constructors will open, and indications are that it will be as good as, if not better than, any in the old days.

Each year since the war we have been able to see the gaps in the aircraft ranks filling up and the new recruits being sorted out, the fittest surviving their strenuous tests to become seasoned regulars in squadron service. Admittedly the "Farnboroughs" of the last two years have reached an especially high standard—so much so that as each came to an end there was a feeling that similar achievement and progress could not be expected to follow again in only twelve months' time. Yet once more the promise could scarcely be greater, and the year's outstanding prototypes no longer fall predominantly in the experimental and research categories but represent the first of the new generation of fighters and bombers. In several cases the civil aircraft will be but one example from a busy new production line.

The fact that the majority of the new aircraft to be displayed are weapons for war need not sadden an occasion which is primarily one for the aeronautical engineer who takes a delight in technical excellence and the demonstration of efficiency. To British aircraft, their engines and complex equipment, we shall refer next week.

In one sense, of course, the presence of many outstanding new military designs will be profoundly comforting and a source of encouragement in their power to avert war. But here, in the present, time obtrudes upon our activities almost as an enemy, or at best as a neutral. Will there be enough time for this country and its allies once more to assemble adequate air defences? Much of our planning and preparation has of necessity been taking the form of a gamble involving the next few years. If the guess has been right, and each successive Farnborough Display makes this more likely, time will become an ally again and in the future, as in the past, will fly on our side.

TO MARK A NOTABLE OCCASION . . .

AS we remark above, there are already indications that the twelfth annual S.B.A.C. Flying Display and Exhibition at Farnborough will surpass even its brilliant predecessors both in the quality of flying and in technical interest. Again this year FLIGHT is to publish special numbers in connection with the event, outstanding among which will be next week's issue, the annual "Britain's Aircraft Industry" number, dated September 7th.

This is an issue that is always warmly welcomed, particularly because its complete, fully illustrated reviews of aircraft, engines, accessories and materials constitute a work of reference that remains of value for many months afterwards. In addition, the issue—most of which will be printed in photogravure—will contain a colour supplement illustrating the interior appointments of the de Havilland Comet as fitted to go into service with B.O.A.C.; and there will be another pictorial feature that is certain to be discussed wherever aeronautical enthusiasts foregather.

The following week's issue (September 14th), appearing during Show week, will include a report on the opening day, with notes on arrivals of aircraft in the "static park," among which some last-moment surprises will undoubtedly appear; and on September 21st we shall give a full story of the flying displays on both the "industry" and "public" days, together with critical observations on technical advances. In each case, the written accounts will be supplemented with many FLIGHT photographs and drawings. Other current events, such as the important aeronautical conferences being held during the month, will also be dealt with. The demand for these Show issues is always heavy, and readers are advised to place advance orders with their newsagents without delay.

New Zealand's National Airline

—may Remain under Government Ownership: Past History and Brighter Prospects

By I. H. DRISCOLL

NEW ZEALAND'S much-discussed, much criticized nationalized airline has produced something of a success story. When the annual report for the financial year ended March 31, 1951, was tabled in the New Zealand Parliament recently, it revealed an operating profit of £8,000. Payment of interest on capital to the extent of £34,000 is still outstanding, but it is thought likely that there will be a clear profit, including full payment of interest on capital, for the current financial year. Past results of the New Zealand National Airways Corporation have shown a profit of £3,426 in 1948; a loss of £246,745 in 1949; and a loss of £328,676 in 1950.

In June of last year, the new National Government announced that it would withdraw from the field of airline operation, selling N.Z.N.A.C. in whole or in part—preferably the former—and later, tenders were invited; then, early this year, the Government said that none of the offers was acceptable, and that the only proposition it was still considering was one which provided for the retention of N.Z.N.A.C. as an entity (apart from the trans-Cook Strait Railways Freight Service) with a 51 per cent Government and 49 per cent private capital holding. Since this last announcement, however, there have been indications that, because of defence requirements, the Government may consider operating a 100 per cent State-owned N.Z.N.A.C.

In either case the organization would become a public corporation. A final decision on which of these two schemes is to be introduced—or, alternatively, if N.Z.N.A.C. is to be retained in its existing form—is still awaited. It will depend to a large extent on the result of the next General Election, which is due to take place tomorrow, September 1st.

It is believed that prospective buyers were deterred by a statement by the late Hon. Peter Fraser, then Leader of the Opposition, to the effect that if the Labour party were to resume power, N.Z.N.A.C. would immediately be re-nationalized without payment of goodwill.

The accompanying tables reveal outstanding progress, particularly in freight carriage.

Results such as these pose the question as to whether the threat to sell caused this nationalized airline to put its house in order. If so, the suggestion is true only to a very limited degree. The major factors which prevented profitable operations in 1949 and 1950 were either of a basic-development nature or beyond the control of the management.

A Wellington newspaper, *The Dominion*, says that, when the Government decided to sell, the staff of the Corporation decided "to make a grandstand finish." The effort proved so impressive as to make it seem likely that the Government would completely reverse its policy. It is generally conceded, too, that the staff showed outstanding loyalty at a time when the Corporation was not in high favour with either the Government or the public. As the personnel consist largely of war veterans of the R.N.Z.A.F., some criticism of the Corporation was construed as meaning—though not intended to do so—that New Zealanders were not capable of operating an airline to international standards. Pilots, ground crews and office staff have all made considerable efforts, with a real sense of personal responsibility, to restore the prestige of civil flying in New Zealand. This, then, is the position today.

It is not without interest to sketch briefly the history that has led up to these current affairs. When N.Z.N.A.C. was formed, it took over from the private operators in New Zealand a fleet consisting of one Lodestar, three Electras, one Rapide, and two Fox Moths. It certainly was not equipped to produce the results which have been achieved at the end of its first five years of life. In 1947, the airline acquired, principally from the R.A.F., 14 Dakotas, 11 Lodestars, two Mk 3 Sunderlands, six Dominies and one additional Fox Moth. Two further Electras were purchased in Australia. If the economic prospects of operating such a mixed fleet were poor, they were not improved by the fact that an immediate shortage of building accommodation made it necessary to use two major maintenance bases—at Palmerston North and Christchurch—in addition to staffing a flying-boat headquarters at Auckland to provide a once-weekly service between New Zealand and Fiji.

However, the New Zealand National Airways Act charged N.Z.N.A.C. with providing air services within and beyond the Dominion to meet the needs of the people of New Zealand and, as in the case of B.O.A.C. and its Lancastrians and Yorks, these military types allowed a start to be made on

N.Z.N.A.C. RESULTS FOR YEAR ENDED MARCH 31st, 1951

Internal Services

	Last year of private operation (1946-47)	Period under Government operation		Percentage differences 1951 over 1950
		1949-50	1950-51	
Route-mileage	2,201	2,622	2,947	—
Miles flown:—				
Revenue	1,407,583	4,823,266	4,797,253	−0·54
Non-revenue (inc. training)	—	185,848	68,603	−63·19
Revenue passengers carried:—				
Schedule	81,340	204,707	238,405	+16·46
Charter	—	3,677	2,230	−39·36
Revenue passenger-miles:—				
Schedule	14,764,385	49,478,365	59,744,623	+20·74
Charter	—	—	380,176	—
Freight (including mail):—				
Schedule (lb)	965,265	3,631,016	6,641,031	+82·89
Charter (lb)	—	616,437	1,150,278	+86·60
Freight ton-miles:—				
Schedule	—	281,573	573,369	+103·63
Charter	—	745,781	1,045,558	+40·1
Mail ton-miles	—	121,251	128,923	+6.32
Total revenue load-factor ...	—	66·2	71·75	—
Regularity (per cent) ...	—	96	98·02	—

Overseas Services (South Pacific Region)

	1949-50	1950-51
Route miles	5,273	3,820
Miles flown	417,631	326,693*
Passengers carried (revenue)	6,336	4,463*
Passenger-miles (revenue)	5,264,202	3,740,529
Freight, including mail (lb)	106,670	101,764
Freight ton-miles (total)	31,829	30,992
Mail ton-miles	16,417	17,712
Total revenue load-factor	64·4	74·76
Revenue passenger load-factor	70·9	77·50

* Decreases caused by the transfer of N.Z.N.A.C. Sunderland service between New Zealand and Fiji to T.E.A.L.

A fine night-impression of N.Z.N.A.C.'s flagship DC-3 taxying out for a service on the main trunk-route. The heading picture on the left shows a busy scene at Nelson (South Island). The crowd had assembled to welcome foreign athletes.

the job of developing a post-war air transport system.

Extensive pilot, engineering and staff recruiting and training schemes were established and nine Lodestars and seven Dakotas were sent to Australia for conversion to a satisfactory standard of passenger comfort. An organization was built up to put them into service on the delivery dates on which they were due to return to New Zealand. Unfortunately, the aircraft were up to a year and more late in arriving, and this expensive organization had to await them.

Meanwhile, a major airfield crisis had arisen for the Corporation. At the time of assembling the fleet, the airfields at Rongotai (15 minutes' surface journey from the heart of Wellington) and Mangere (11 miles from Auckland) were available for operations with Lodestars, Electras and Dominies, although they were closed to Dakotas, which had to use Paraparaumu field (35 miles from Wellington) and Whenuapai (20 miles from Auckland). In spite of the fact that the long road journeys which the Dakota services entailed caused a loss of passenger-bookings, and an increase in overheads, the Dakotas were competitive so long as they could be filled, for each could be operated with 29 passengers at about the same cost as a Lodestar with 15.

Airfields Closed

At the end of 1947, however, both Rongotai and Mangere were closed to Lodestars and Electras, while Dominies were not permitted to operate to the former airfield. This restriction heralded heavy financial consequences for the Corporation. The services between Rongotai and Blenheim and Rongotai and Nelson, for which a substantial goodwill had been paid to Cook Strait Airways, suffered a decline in patronage estimated at 50 per cent for Blenheim and 30 per cent for Nelson. Services from Wellington to other cities took very often half as long again to accomplish, most of the extra time being taken up in road travel. Apart from the unpopularity and cost, there were repercussions throughout the whole of New Zealand's air network, for Wellington is the hub of the system and the capital of the Dominion and many air travellers journey to and from this point. Even today, one of the most criticized routes is Wellington-Auckland, linking the two largest centres of population; on this service, 1 hr. 55 min. only is spent in flight compared with 2 hr 20 min on the ground.

Other costly initial difficulties in operating services through Paraparaumu included a complete lack of hanger accommodation, so that aircraft had to be ferried morning and evening for maintenance checks at airfields 50 or more miles distant; and lack of housing accommodation near Paraparaumu airfield meant heavy staff costs. Finally, the Lodestar, on which considerable forward planning had been based, was forced to operate on equal terms with the DC-3 and consequently it no longer retained any economic merit.

Two ways only: Rarotonga, one of the more picturesque airfields.

Despite these very substantial setbacks and a loss in two years of some £575,000 N.Z.N.A.C. has shown every sign in 1950-51 of having got on top of its problems. The institution of twelve strategically placed sales offices throughout the Dominion and Fiji has provided a system of centres which have promoted air travel through some three hundred agents. Of New Zealand's total population of less than 2 million, some 245,090 passengers used N.Z.N.A.C. last year. In addition, nearly 8 million lb of freight and mail were carried.

Dakotas Re-fitted

The modification of the seven DC-3s converted in Australia to 24-seaters, the development of an engineering organisation capable of undertaking the full conversion of military Dakotas to DC-3D standards at less than half the cost of sending the aircraft to Australia, and the acquisition of additional Dakotas from the R.N.Z.A.F.—all these factors have permitted the Corporation to carry more passengers and freight on scheduled routes in 1950-51 than ever before while logging 1,200 fewer flying hours than in the previous year. The fleet has been streamlined to a prospective 14 DC-3 passenger aircraft (four are under or awaiting conversion), three DC-3 freighters, six Lodestars in service, six Dominies and three Fox Moths. The retention of the small types is necessary to operate to districts where the airfields will not accommodate larger aircraft. The Sunderlands and Electras have already been retired and it is expected that the Lodestars will also disappear before the end of 1951.

In addition to building up the New Zealand internal network, N.Z.N.A.C. has pioneered two South Pacific airlines, with a total unduplicated route mileage of 5,273. Inaugurated in November, 1947, a flying-boat service between Auckland, Suva and Labasa proved most popular. For economic reasons it was handed over to T.E.A.L. when that organisation took delivery of Solents, and N.Z.N.A.C. was thereby permitted to close down its flying-boat wing; for two years, however, the Corporation had undertaken the major development of air transport in this new sphere.

Two military Sunderlands were converted to excellent passenger standards by the engineering staff at Hobsonville, Auckland— the biggest aircraft conversion job undertaken in the Southern Hemisphere. Offices were established in Fiji and the administration of air services leading from New Zealand to the remote islands of Norfolk, Fiji, Tonga, Western Samoa, Aitutaki and Rarotonga brought air transport to these sparsely populated regions of the South Pacific for the

(*Concluded at foot of page* 243)

NEWS OF THE WEEK

More About Russia's Aircraft

IT is confirmed in Washington that a captured Mig-15 Soviet-built jet fighter, shot down by carrier-borne aircraft off the coast of Korea, is now at the Wright-Patterson Air Force Base, for detailed study. It is described as being in "fairly intact" condition, though it is doubtful if it can be put into flying trim.

The Mig was shot down last spring and fell in shallow water near Simni Island, off north-west Korea. A raid by South Korean paratroops, with the object of securing the machine, was driven off by air attacks, but on July 20th General Ridgway, the United Nations Supreme Commander, despatched a Naval force, including the 13,000-ton aircraft carrier *Glory*, which, with the help of divers, secured the prize.

Efforts were made to capture a second Mig which fell inland, but the Naval landing party was beaten back by the enemy.

More news of Soviet aircraft comes from a correspondent in Germany, who says that fuel for Russian jets stationed in that country is produced at Boehlen, near Leipzig, and at Zwickau. The tank wagons to be seen on all airfields in the zone bear the marking D.H.D. (Druck-Hydrier-Düsenstoff), signifying "pressurized hydrated jet fuel." This, it is reported, is further designated "Alc. Naphtene," and has a boiling point of 180 deg. Fuel for reciprocating engines is produced in the same works under the designation H.L.K. (Hoch-Leistungs-Kraftstoff), signifying high-octane fuel. The octane value is reported to be 120.

It is further reported that at Jüterbog the runway has been lengthened to 2,000 metres, the work having been commenced on February 1st and finished on April 20th. Some 260 workers were engaged in this enterprise. Commander of the airfield is Col. Limonow and reconstruction work was controlled by General Orlow. Other leading figures are named as Capt. Baranow and Eng. Capt. Iwshin. In April this year five Mig-15s, three lease-lend Mitchells, and 60-70 Tu-2s were stationed at Jüterbog. Since that date the Tu-2s have disappeared and the new twin-jet bombers are coming in. There are four underground tanks capable of holding 50,000 litres of fuel.

Information has also been received that, in addition to numerous jet bombers at Schoenwalde, over 170 Il-10 ground-attack aircraft are stationed at the nearby airfield of Staaken. A squadron of nine Li-2s (Dakotas) has been busy this month in bringing spares to this great base in the centre of the Eastern Zone.

There is an unconfirmed report of a new type of Russian aircraft, probably a fighter, having an unswept mainplane and swept back tailplane, as on the new twin-jet bomber. The power plant is internal.

The Corporations' Annual Results

THE annual reports and operating results of the two British Airways Corporations for the year ended March 31st, 1951, were published last Wednesday, August 29th.

They show that in a difficult year, and in spite of a background of rising prices throughout the world, both B.O.A.C. and B.E.A. have made substantial all-round progress which is reflected in a marked improvement in their financial results. As the advance copies of the reports became available only shortly before this issue went to press, we publish here a summary containing only salient features, and intend to include a fuller examination of the results in a forthcoming issue.

British Overseas Airways Corporation: A reduction of £3½ million was made in the annual operating deficit. In 1949/50 the loss was £7.79 million; it has now been whittled down to £4.56 million, an improvement of 41 per cent. Flight capacity offered was increased by 18 per cent to 161,700,000 capacity ton-miles, while operating revenue for the year rose by 24 per cent to £24.25 million. Operating costs, which had been reduced from 56.6 pence per c.t.m. in 1947-48 to 43.5 pence per c.t.m. in 1949-50, were brought down still further to 39.5 pence in the year under review, a reduction of 30 per cent over the three-year period.

In spite of the increase in output and the larger amount of traffic carried, it was still found possible to reduce B.O.A.C.'s personnel strength; at the end of the year only 16,000 persons were being employed, as compared with 17,340 twelve months earlier. The productivity of the staff, measured in c.t.m. per employee, rose to 9,770 compared with 6,963 in 1949-50, a gain of 40 per cent. These advances were assisted, states the report, by the facts that during the year under review the Corporation's administrative pattern had been re-organized and integrated into a more effective commercial entity; that by the end of the year B.O.A.C. was, for the first time, fully equipped with modern four-engined pressurized aircraft; and that the Corporation was able progressively to concentrate its formerly dispersed maintenance organization in the United Kingdom at two bases, London Airport and Bristol (Filton).

British European Airways Corporation: B.E.A.'s loss for the year was reduced to £979,000 as compared with £1.36 million in 1949-50, a reduction of 28 per cent. The loss for 1950-51 is actually little more than one third of that incurred in 1948-49, which was £2.76 million. The volume of traffic carried rose to 31,680,000 load ton-miles (an increase of 23 per cent on the previous year's figure), while the amount of revenue earned increased by over £2,000,000 to £9,000,000—an increase of 31 per cent. The total of passengers carried—939,000—was 188,000 more than that for the previous year.

Although the amount of traffic handled increased by as much as 23 per cent, personnel strength rose by only 11 per cent to 7,279. As an indication of increasing efficiency, it is worth noting that the productivity-per-employee figure rose by 21 per cent to 7,769 c.t.m. per employee. This is all the more remarkable in view of the relatively short stages flown on most of the Corporation's routes, the delays in the delivery of new aircraft, and the need to employ small and uneconomic machines on several routes. Unit operating costs were further reduced by 8 per cent from the 1949-50 figure to 42.9d per c.t.m.

It will be recalled, incidentally, that the past year was a notable one for B.E.A. in that they had the honour of introducing the world's first regular passenger helicopter service and, in July and August, 1950, the first passenger services with turboprop-powered aircraft.

Thus the combined losses of the two Corporations last year amounted to £5.54 million as compared with £9.16 million in the previous year—a reduction of 39 per cent. Their output increased by 22 per cent from 177,900,000 c.t.m. in 1949-50 to 216,500,000.

Over the four years commencing 1947-48—the first full year of operations under the arrangements established by the Civil Aviation Act of 1946—the loss per unit of output has been steadily reduced from 23.8d per c.t.m. to 6.0d per c.t.m., a sure indication of the progress which Britain's nationalized airlines are making towards their goal of a combined annual operating profit.

The two reports are obtainable from His Majesty's Stationery Office, at prices of 2s.6d (B.O.A.C.) and 3s.6d (B.E.A.) respectively.

RECONNAISSANCE: The de Havilland Comet at the new Livingstone Airport, Rhodesia, during the return journey from its recent trial flight to Johannesburg.

SNARLER: When an Armstrong Siddeley Snarler rocket motor is installed in a suitably modified P.1040 it becomes the apparently fearsome P.1072 illustrated. Properly controlled, refuelling is harmless enough, and the fuels at present employed—water/methanol and liquid oxygen—are innocuous. Liquid oxygen needs to be stored carefully to prevent vaporization, but is non-toxic, non-explosive and non-corrosive. Work started on the Snarler in 1947 and a considerable amount of test firing has been done. Recently a special-category flight clearance was obtained and the motor was flown in the tail of the Hawker P.1072. The aircraft is to appear at Farnborough. Designed full-thrust endurance between refuellings is 3 min., but this can be varied.

Conferences Galore

SELDOM, if ever, can there have been such a conjuncture of important aeronautical occasions as those which will occur during the coming few weeks. The S.B.A.C. Flying Display and Exhibition is, of course, the focal point and, in fact, the two major conferences have been deliberately arranged to take place at this time in order that foreign delegates may see the show—or, if they would be attending it in any case, in order to save them the second journey which a conference at any other time would entail.

Opening in London on September 10th, the Seventh I.A.T.A. General Meeting (some news about which appears on page 262 of this issue) will bring delegates from air-transport organizations all over the world. It will be followed (September 25th-October 5th) by the Commonwealth Air Transport Conference. On the scientific side, there is the Third Anglo-American Aeronautical Conference of the R.Ae.S. and I.Ae.S. (Brighton, September 4th-11th), while the British Interplanetary Society is holding its Second International Congress on Astronautics (London, September 3rd-8th). The beginning and end of this period of conferences, also, will be marked by the delivery before the R.Ae.S. of two "classic" aeronautical lectures—the 39th Wilber Wright Memorial Lecture and the Seventh British Commonwealth and Empire Lecture (September 10th and October 4th respectively).

Lists of the papers to be read at the Anglo-American and Astronautics meetings have already appeared in these pages. The following are brief notes on some of them.

Of the American contributions, the majority are concerned with the aerodynamics of what may be called the Supersonic Era upon which we are now entering. Thus N. J. Hoff (Brooklyn Polytechnic Institute) is concerned with the structural problems that will face designers during the coming years; A. H. Flax and H. R. Lawrence (Cornell Aeronautical Laboratory) have made a study of the Aerodynamics of the law-aspect-ratio wings of supersonic aircraft, with particular reference to the problems which they bring at subsonic speeds; I. E. Garrick (Langley Aeronautical Laboratory) gives some illuminating information on research into high-speed flutter, some of which work has been carried out with the aid of winged rockets; a particularly exhaustive study of dynamic stability and control problems has been prepared by William Milliken, Jr. (Cornell); and research into airflow problems by methods designed to overcome the limitations of the wind tunnel (including, again, the use of rockets) is detailed by John Stach of the Langley Laboratory. Rocketry pure and simple is the subject of two other American papers, one on heat-transfer and the other on the design of jet nozzles.

Of quite a different type is Jerome Lederer's (Guggenheim Aeration Safety Center, Cornell) paper bearing the rather formidable title *Infusion of Safety into Aeronautical Curricula*; the author feels that "designing for safety" is not taught nearly so thoroughly as it might be in America's aeronautical-engineering training establishments today.

But of all the papers to be presented by the American delegates the one that seems likely to have the widest appeal is a most stimulating study by Ernest G. Stout, of Consolidated Vultee Aircraft. In it he observes that the flying-boat has, by tradition, largely come to be regarded (and designed) as a flying *boat*—i.e., a big, comfortable but comparatively slow transport. He then goes on to suggest—citing an absorbingly interesting series of experiments with radio-controlled models—how the requirements of marine operation could be reconciled in the design of an ultra-modern, swept-wing transonic aircraft.

The distinguished authors of the British contributions will forgive us if, at this stage, we mention no names; suffice it is to say here that their papers cover a wider range of subjects than those of our American friends; that several of them deal with practice—e.g., jet-transport operation—rather than theory; and that, among them, the Commonwealth is represented by papers.

Loss of the H.P.88

WITH deep regret, *Flight* records the death of Mr. D. J. P. Broomfield, D.F.M., in an accident at Stansted, Essex, on August 26th, and the loss, on the same occasion, of the Handley Page H.P.88 crescent-wing research aircraft.

The H.P.88 had arrived at Stansted on August 23rd with a team of technical personnel. It had completed between 20 and 30 flights since first taking the air on June 21st, at Carnaby, Lincs, with Mr. G. R. I. Parker at the controls. Mr. Broomfield himself had made several flights. Reports indicate that on August 26th it had been airborne for between 10 and 15 minutes before the accident and was flying along the main Stansted runway when it suddenly disintegrated. Eye-witnesses spoke of "three dips," a "vertical climb," a "change of engine note," and an "explosion." Burning wreckage descended on to the airfield. The Ministry of Supply state the cause of the crash is unknown.

The H.P.88—designed by Handley Page, Ltd., in collaboration with Blackburn and General Aircraft, Ltd.—was powered by a Rolls-Royce Nene and the fuselage was basically that of a Supermarine 510. Ground views appeared in *Flight* of June 29th and July 6, and an unauthorized photograph, purporting to show the machine in flight a minute before the crash, and apparently reproduced upside-down, appeared in some editions of a London newspaper of August 27th. Large flaps were clearly visible aft of the wing trailing-edge, but the picture had apparently been retouched in such a way that the wing-tips appeared pointed, giving the impression that the wing was of delta form. Various printed reports have conveyed the same erroneous idea. The H.P.88 was due to appear at the S.B.A.C. Display next month.

"Duggie" Broomfield, an ex-bomber pilot who won the D.F.M. during the war, had been a test pilot for Handley Page, Ltd., for three years. It was he who flew a Marathon to Africa last summer; he also piloted the Hermes V when, on June 5th, it crossed from London Airport to Paris (Orly) in 46 minutes.

We are sure that all who knew Duggie Broomfield will join us in extending sympathy to his widow and two children.

NEW ZEALAND'S NATIONAL AIRLINE

(continued from page 241)

first time. In addition to the Sunderland route the Auckland-Norfolk Island and Auckland-Rarotonga routes were inaugurated by DC-3s and have operated without a single cancellation.

In the near future, probably a route will be opened between New Zealand and Tahiti by T.E.A.L. Solents, which may take over from the DC-3s and, thereby, release them to cope with the constantly increasing demand for air travel within New Zealand. In this connection, incidentally, a successful survey flight was made recently by a T.E.A.L. Catalina.

The air freight service across the Cook Strait is also operated by N.Z.N.A.C., except for traffic emanating from the Railways Department, which is known as Rail-Air. This service provides for the transport of railway freight between the North and South Islands, the respective airfields used, being Paraparaumu and Woodbourne. Straits Air Freight Express (S.A.F.E.) recently took over this traffic, using two Bristol Freighters chartered from Air Work, Ltd. (of which organization S.A.F.E. is actually a subsidiary). During the period of the recent industrial strike this company was also assisted by Curtiss Commandos of Civil Air Transport, an American operator based in Formosa.

HERE AND THERE

Cody Field?

THAT Farnborough's airfield should be named after S. F. Cody, who conducted many of his flying experiments there, has been suggested by Mr. G. A. Broomfield, a retired railway clerk, who helped "The Colonel" to build his first aeroplane.

Ice-cap Rescue

THE first helicopter landing on Greenland's ice-cap was made recently, when a Sikorsky H-19 picked up the crew of a Grumman Albatross amphibian which had landed on a 5,000-ft plateau and been unable to take off again owing to unexpected thawing of the surface.

Bell XD-1 Destroyed

WHILE airborne in a B-50, prior to a test flight, the Bell XD-1—latest development of the Bell X-1 rocket-propelled research aircraft—is reported to have exploded and burnt on August 23rd. Lt. Col. Frank K. Everett, the pilot, climbed to safety inside the B-50 an instant before the machine was jettisoned. The B-50 suffered minor damage.

Fresh Fields

WELL-KNOWN as a professional parachutist in this country before the war, Benno G. de Greeuw is shortly leaving to settle in the United States. He made his 1818t and final jump at Luton in 1946; touching-down in a high wind, he sustained injuries which compelled him to forsake parachuting forthwith. During the war he served with the R.C.A.F.

A.O.A. Conference

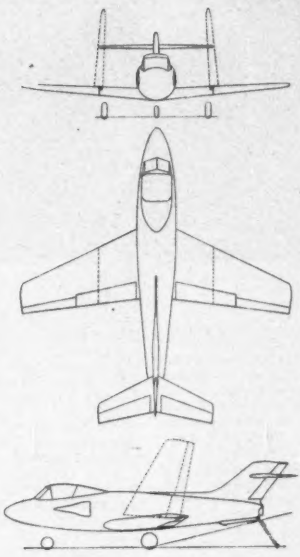
DURING the annual conference of the Aerodrome Owners' Association, to be held at Bristol on September 5th and 6th, two papers will be read—*Construction and Maintenance of Runways*, by J. R. Harris, B.Sc., A.M.I.Mun.E., and *The Selection of Helicopter Sites*, by J. L. Briscoe, D.F.C. As previously reported in these pages, the delegates will also visit the Bristol Aircraft and Westland factories and Bristol Municipal Airport.

Philatic Bequest

ACKNOWLEDGED to be the finest of its kind, the Fitzgerald Collection of airmail stamps has been presented to the British Museum by Mrs. Augustine Fitzgerald. As well as stamps, it includes souvenirs of such early aeronautical events as the balloon flights during the siege of Paris in 1870 and a number of documents, among which are Sir John Alcock's original pilot's licence.

Brabazon Gets Around

THE Bristol Brabazon went on a four-hour journey from Filton to Belfast and back last Saturday—the longest it has yet made—to fly over the R.A.F.A. display held at Sydenham Airfield. Walter Gibb and Ronnie Ellison were the pilots, and among those on board was a party of A.T.C. cadets—the first time that the Brabazon has carried passengers other than Government officials, technicians and Pressman. On Wednesday last the big aircraft was due to visit Prestwick for a series of demonstration flights. The Ayrshire airport will thus have been the fourth airfield from which it has operated, the others being Filton, Farnborough and London Airport.



STEPPING-STONE: General arrangement of the projected Boulton Paul P.119 jet-conversion trainer (see page 245). *Naval version dotted.*

Congratulations!

A MARRIAGE took place quietly in London on August 22nd between Sir Geoffrey de Havilland and Mrs. Joan Mary Mordaunt. They met in Kenya and share the interest in big game photography for which Sir Geoffrey is now well known. Lady de Havilland also has a keen interest in aviation.

Death of J. P. Bickell

MANY who worked with him in this country will be sorry to hear of the death, in New York on August 24th, of Mr. J. P. Bickell. A Canadian who had had a notable career as a financier, he was invited by Lord Beaverbrook to serve on his Aircraft Supply Board in 1940. After two years' service on the board Mr. Bickell returned to Canada to take over control of Victory Aircraft, Ltd

R.A.F.A. Commemoration

ON Sunday week, September 9th, the Royal Air Forces Association is to hold its annual Service of Remembrance at the R.A.F. Memorial on the Thames Embankment. On the afternoon and evening of the same day, a pageant with music, entitled *Man Takes Wings*, will be held at the Royal Albert Hall in celebration of the 21st anniversary of the Association's formation.

Netherlands Strength

THE Netherlands Ministry of Defence announces that all Dutch military airfields will be ready for operations early next year. Construction of Gloster Meteors is almost up to schedule, and the supply of Republic Thunderjets to the tactical air force is running smoothly. The programme in hand calls for the formation of 21 squadrons, about equally divided between Meteors and Thunderjets.

U.S. Navy Carriers

THE United States Navy Secretary stated in Washington last week that the Navy would ask for more very large aircraft carriers after completion of tests with models. He confessed to having made a mistake in previously announcing that more big carriers would not be required until completion of the 59,100-ton vessel, construction of which was recently started at Newport, Virginia.

FARNBOROUGH FACTS

FOR the guidance of intending visitors to the S.B.A.C. Flying Display and Exhibition on the "public days" (Saturday and Sunday, September 15th and 16th) the essential facts are: Admission: Pedestrians 3s; children (under 16) 2s; cyclists 4s. Vehicles: Motor cycles 2s (riders at pedestrian rates); combinations and three-wheelers (with occupants) 10s; cars (with occupants) 20s; coaches (with occupants) £5; double-decker buses (with occupants) £10. Reserved enclosure 10s per person extra (children 5s). Advance bookings are handled by Auto Parks, Ltd., 1, Maclise Road, London, W.14. (Shepherd's Bush 5385.)

The S.B.A.C. informs us that there will be no restrictions on the normal use of cameras by the public.

IN BRIEF

THE current issue of *Precision*, house-journal of Automotive Products Co., Ltd., contains a drawing of the S.E. 2410 Grognard; this new French jet fighter is equipped with Lockheed Servodyne control-assisters.

* * *

In commemoration of the golden jubilee of the R.Ae.C., a special enlarged issue of *The Royal Aero Club Gazette* is to appear during October.

* * *

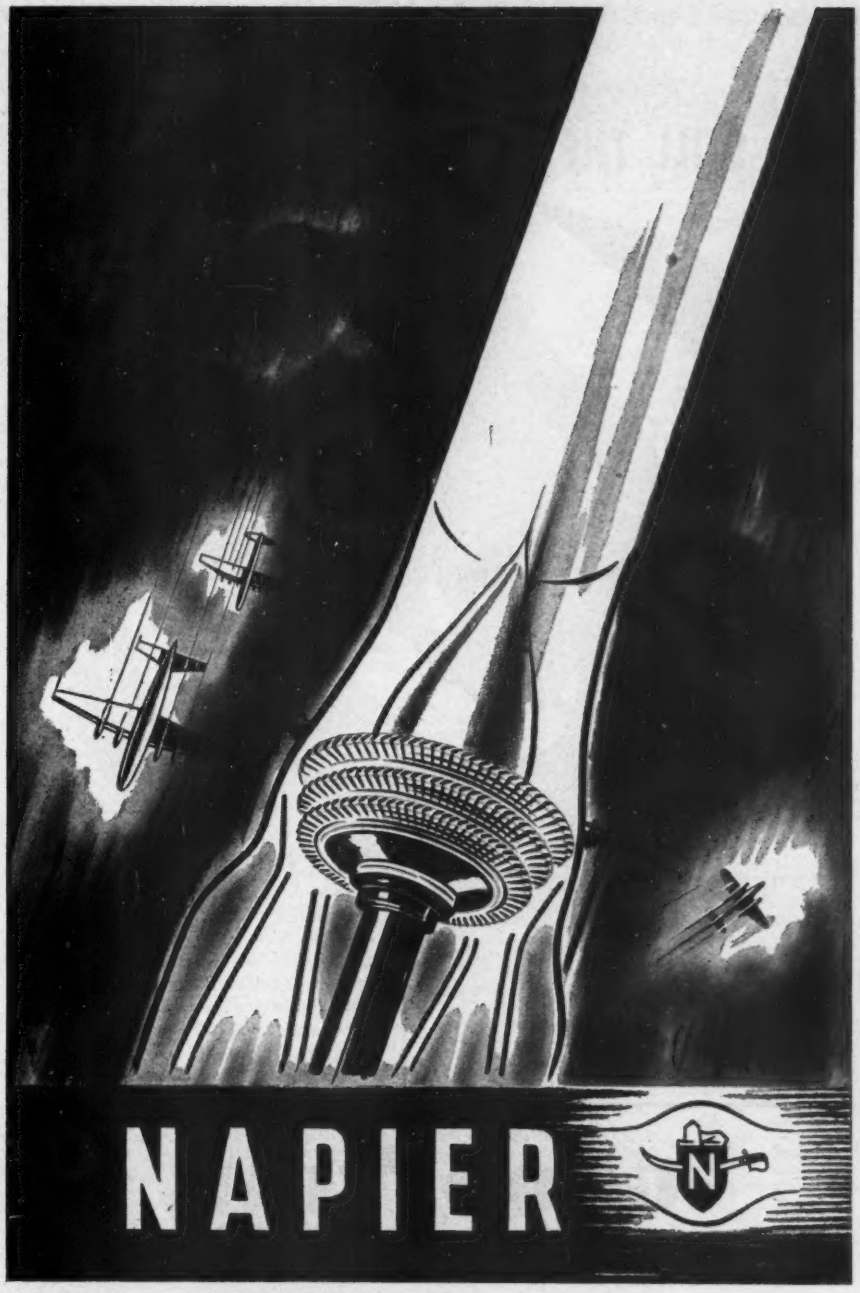
A hot-water swimming bath installed at the R.A.F. Rehabilitation Centre near Leatherhead, Surrey, has a purification system designed and made by the Pulsometer Engineering Co., Ltd., Reading, well known as makers of aircraft fuel pumps.

* * *

Bakelite, Ltd., announce that Sir James Swinburne, F.R.S., who was chairman of the company from its inception until 1948, has resigned his directorship. The following have been appointed to the board: Mr. P. Huffman, Mr. N. H. Docker, Mr. C. C. Last and Mr. G. W. Hodds.

* * *

The Scientific Film Association is to hold its fifth congress, at The Hague, from September 15th to 22nd. The research-film committee hopes to show many examples of special applications of cinematography, and any workers willing to contribute material are asked to communicate at once with the S.F.A. at 4, Great Russell Street, London, W.C.1.



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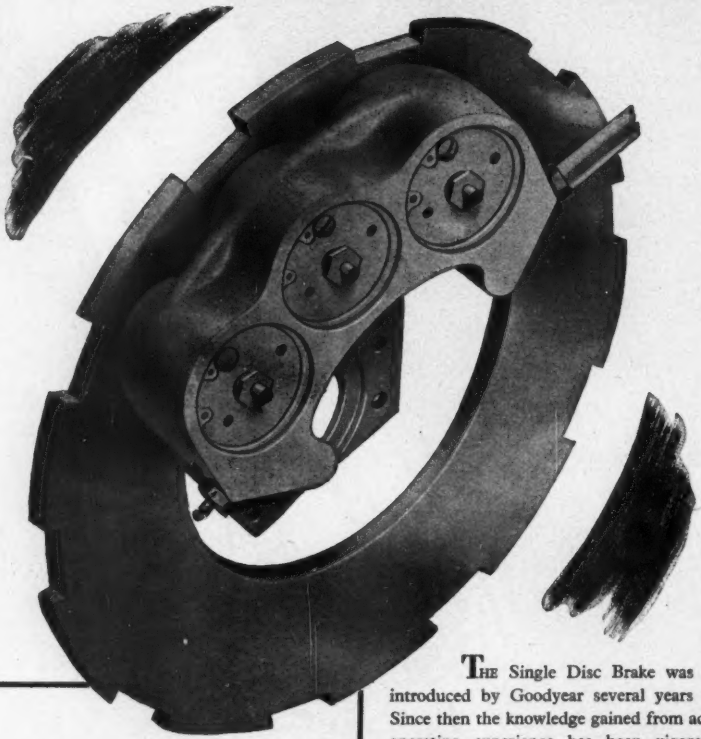

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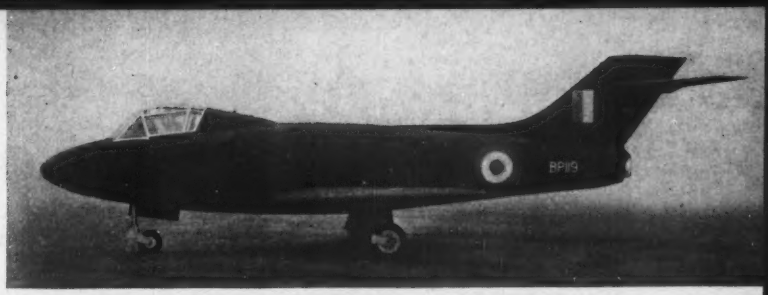


The P.119 is as shapely as an interceptor and particularly pleasing about its square-cut tail surfaces. Note the flush air intake.

JET-CONVERSION TRAINER

Projected Boulton Paul P.119: Side-by-side Seating and Derwent Power

A TIMELY announcement from the Boulton Paul company reveals the existence of a private-venture jet-trainer project known as the P.119, of which an elaborate mock-up has been constructed. Indications are that this would be a most versatile aircraft, capable even of fighter duties, though primarily intended for the training role. A single Derwent is specified, or a Nene could be installed as an alternative, bringing a marked increase in performance. With Derwent power, the endurance with normal tankage and with allowance for taxying, take off, climb and landing, would be 1 hr 45 min. at 30,000 ft. Normal operating speed would be in the region of 400 m.p.h.

From the illustrations it will be noted that the P.119 has exceptionally clean lines in spite of the wide cockpit necessitated for side-by-side seating. The surfaces are square-cut and moderately swept. Manœuvrability is expected by the makers to be of a very high order—superior, in fact, to that of standard front-line fighters.

An excellent view is afforded to both pilots, and their cockpit is pressurized and heated and fitted with a jettisonable hood and ejector seats. Simultaneous or individual ejection would be possible. The crash-protection frame is located immediately behind the seats. Flying and engine controls are duplicated, and provision is made for amber or blue synthetic-instrument-flying screens.

In addition to the relatively simple job of flying conversion to jet-fighter standard, which includes advanced instruction in day and night flying, provision is made for several kinds of applied training. Under this heading is included instruction in gunnery, navigation, bombing and rocket attacks. With the possibility of secondary fighter and policing duties in mind, provision is made for two 20 mm. guns and carriers for external bombs and rocket projectiles.

A naval version of the P.119 is also foreseen, and in place of the one-piece wings of the landplane version—simply attached to the fuselage centre section by four pin joints—wings folding at approximately half-span with either manual or power operation, would be provided.

Pneumatics have been selected to operate the main services—for the nosewheel undercarriage (incorporating lever suspension and shock-absorbing capacity adequate to deal with a vertical velocity of 14ft/sec) and for flaps, dive-brakes and wheel brakes.

The Boulton Paul company have demonstrated their skill in producing simple and economical structures which are easy to service, maintain and repair, and these qualities, which are essential to a successful trainer, are to be found in the P.119. Light alloy stressed-skin construction is employed, and the underside fuselage panels, which may suffer damage in emergency landings, are especially designed for ease of replacement.

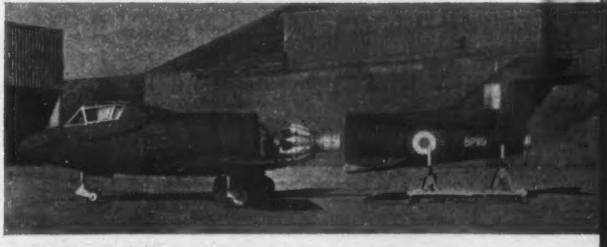
A Rolls-Royce Derwent is installed in the mock-up here illustrated, but the design of the rear fuselage is such that a Nene could be substituted with the minimum of trouble. The fuel tanks are located centrally in the fuselage between the air intake ducts; this has the advantage that the change of c.g. with tanks full and tanks empty is reduced to a minimum. Flush side intakes and twin ducts feed the plenum chamber, while the position of the turbine is such that only a very short jet pipe is required.

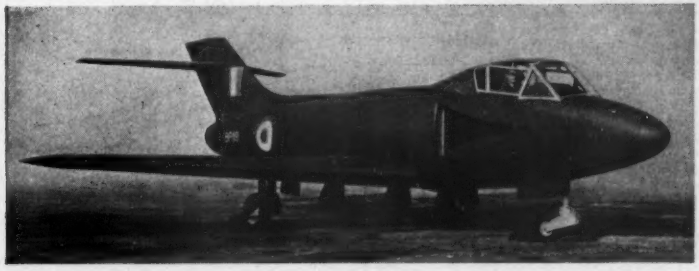
It will be noted that the mounting for the turbojet is carried on the forward portion of the aircraft, immediately aft of the rear wing spar attachments. The entire tail portion including the wing root fillets can be withdrawn on a cradle leaving the turbojet completely accessible for inspection, overhaul or change. It has been estimated that a power unit could be replaced within an hour. It is suggested that the choice and use of alternative power units has the advantage of widening the scope of the training for pupils and from the point of view of the ground crews.

Data for Boulton Paul P.119 Trainer

Span		38ft 9in
Length		42ft 5in
Height		12ft 3in
Wing area		298.5 sq ft
All-up weight		9,650 lb
	Derwent	**Nene**
Max. speed	475 m.p.h. at 22,500ft	555 m.p.h. at 10,000ft
Max. cont. speed	430 m.p.h. at 25,000ft	525 m.p.h. at 15,000ft
Climb to 20,000ft	7.5 min	4.5 min
Climb to 30,000ft	14 min	8 min
Service ceiling	41,000ft	50,000ft

C. A. drawings appear elsewhere in this issue.





Accessibility and ease of maintenance are regarded as essential features of a trainer. The Derwent in the P.119 is drawn from its tail sheath for attention or replacement.

A spacious cockpit affords both pilots a good forward and downward view. The landing-gear is squat and widely spaced.

THE ICING PROBLEM

—from the Airframe Designer's Angle: How Ice Forms: Means of Prevention and Dispersal

By S. S. SCHAETZEL, D.I.C., B.Sc., D.L.C., Grad.R.Ae.S.

BEFORE going last year to Australia, where he is in the Project Design Group of the Government Aircraft Factories, Melbourne, the author was on the design staff of the British Aeroplane Co., he was engaged on the arrangement of the de-icing systems of the Brabazon and the Bristol 175. Among interesting facts which he mentions here is one of highly topical importance that will not, perhaps, have been generally recognized by the non-technical—namely, that no anti-icing measures are necessary on aircraft designed to fly at over 500 m.p.h., since kinetic heating of the aircraft skin can be relied upon to do the job automatically.

ICING occurs on the forward-facing surface of any object moving through an atmosphere in which there is a certain concentration of supercooled water droplets and where the wet surface temperature is below 0 deg. C. It follows, therefore, that ice will form on the leading edge of the aerofoil surfaces of an aircraft, on the nose of the fuselage, at the lips of the intakes, on whip aerials, in fact on all "profiles," as soon as the relevant ambient conditions occur.

It has been estimated by the Canadian airline companies that their aircraft spend about 5 per cent of their total flying time in icing conditions. Some form of anti-icing protection must therefore be provided in order both to safeguard the airworthiness of the aircraft and to allow operation to continue during that quite appreciable amount of time. In the case of aircraft operating in other climates, e.g., in Australia, the percentage of flying time spent in icing conditions is smaller, but, on the other hand, very severe icing is often encountered in tropical cloud formations.

It is advisable to differentiate at this stage between the terms anti-icing and de-icing. *Anti-icing* aims at preventing ice forming at all whereas *de-icing* attempts to remove (usually periodically) the ice already formed. A de-icing system is usually lighter than a comparable anti-icing installation.

In this article it is proposed to deal only with airframe icing, and not with that of engines and airscrews. Nor will windscreen icing be discussed; though it concerns the airframe design, it is a somewhat detached and specialized aspect of the main problem.

Precautions against icing have to be envisaged at an early stage in the aircraft design, since no system incorporated as an afterthought is likely to prove wholly satisfactory.

Meteorological Factors.—Variables determining the rate of ice accretion on any forward-facing surface are as follow :—

(*a*) ambient temperature.
(*b*) liquid water content per unit volume of cloud (m) (measured in g/m^3).
(*c*) diameter of water droplets present. (d)
(*d*) true air speed of section subject to icing. (V)
(*e*) nose radius of the section. (D)
(*f*) thickness/chord ratio of the body concerned.
(*g*) altitude effect (i.e., the variation of ρ) is also important. In a design, however, one critical altitude is considered—usually the upper limit for continuous maximum icing, i.e., 20,000ft.

Because of the great number of variables and the difficulty of standard measurements there is still lack of reliable and generalized flight data, although a great number of flight measurements have been made, mostly in the United States. Ref. 1 provides what is considered to the be most reliable data on the subject. Although the icing conditions have been classified under several headings (such as instantaneous max., continuous max., etc.) and each of them subdivided according to the ambient temperature, yet it is impossible to obtain from these data any "Standard Icing Conditions" comparable with the Standard Atmospheres. It is also probable that the cloud formations, in which the measurements were made, were typical of the American Continent and that in other parts of the world different icing conditions might be encountered. It is well known, for instance, that icing encountered in the tops of cumulus clouds of tropical thunderstorms surpasses in severity anything met in temperate climates.

Some authorities are of the opinion that there is no limit to the severity of instantaneous icing. This, however (as will be seen later), is of less importance to the airframe designer than it is to the engine designer. In general, continuous icing does not occur above 20,000ft, but instantaneous icing has been known to occur very much higher.

In spite of all this, it is the opinion of the author that, when sufficient data are available (data based on the frequency of occurrence) some sort of "Standard Icing Conditions" should be evolved. After all, the Standard Atmospheres represent nothing else but the mean conditions occurring throughout the year and not the worst high or low temperature and pressure cases in any climate. The danger of the severity of icing exceeding the maximum is, if anything, less than, for instance, the danger of insufficient power for take-off at a tropical airfield, when the temperature exceeds by several degrees the tropical maximum conditions defined in the Standard Atmospheres. Yet this does not seem to worry the designers, who for many years now have designed their aircraft against what are, after all, arbitrary conditions.

The Mechanism of Icing.—When an object is moving at a subsonic speed air is deflected a certain distance in front of its leading edge. Depending on the size and the thickness/chord ratio of the object this disturbance is felt a longer or shorter distance ahead. By reason of their inertia however, the water droplets suspended in air are not deflected with the streamlines but, depending on their size, the free stream velocity and the relative abruptness of change of direction of the streamlines, assume a less curved path. In consequence, a certain proportion of the droplets strikes the forward-facing surface of the moving object (Fig. 1).

The proportion of water striking the surface divided by the total quantity of water present in the path of the frontal area of the moving object is called the efficiency of catch (η). It is clear that the efficiency of catch will be less for large, thick sections, since the disturbance is felt farther ahead than in the case of small, thin objects and, consequently, more droplets can be deflected and thus avoid striking the body.

Several forms of icing are possible, depending on the ambient temperature and on the liquid water content of the cloud. The most common forms are glaze ice and rime ice. Rime ice forms when the ambient temperature is low and the l.w.c. is low as well. It usually follows the shape of the section, is porous, has a matt surface and presents little danger to airworthiness. There is usually no run-back, i.e., all water striking the body freezes immediately after impact.

Glaze ice occurs when the ambient temperature is high (i.e., just below 0 deg C) and the l.w.c. is high. It begins to form at a very high rate, in the characteristic "cauliflower" shape and with a very rugged outline. Owing to the release of the latent heat of fusion at this relatively high temperature all the water does not freeze immediately, and there is a considerable amount of run-

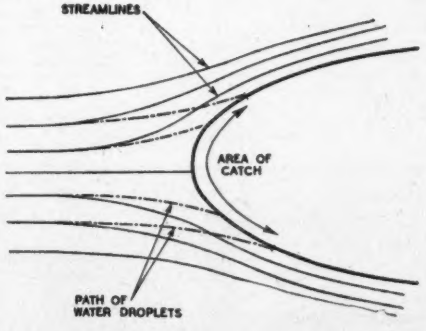


Fig. 1. Deflection of water droplets in airstream past a profile. Depending on certain factors, a larger or smaller proportion of the droplets is caught.

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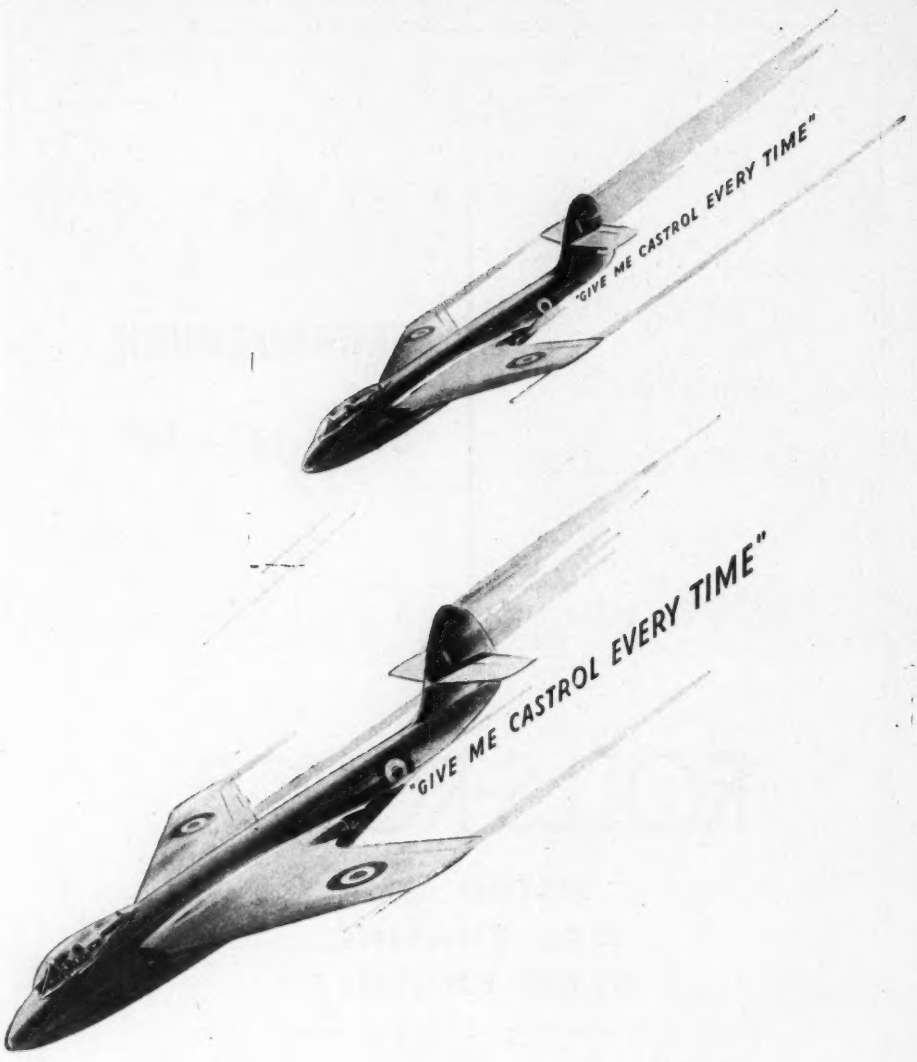

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THE ICING PROBLEM . . .

back. Secondary icing centres appear on all excrescences, such as rivet heads, skin joints and access panels. This form of icing is extremely dangerous. The shape of the aerofoil section is completely spoiled; and the smaller the section the higher the relative rate of icing and the subsequent alteration of shape.

Sometimes freak forms of icing occur. In one of the T.C.A. reports there is mention of a very severe case, where ice started to form on the lower surface of the wings. Spikes of ice, over 2in in length, were formed on the rivets and were so hard that it was impossible to snap them with the fingers alone. The loss of lift was very noticeable and a rapid loss of height occurred, even with full power on.

Measuring Severity of Icing. Methods of Calculating Catch on Aerofoils.—There are several methods of measuring the severity of icing as represented by the three "atmospheric" variables, i.e., temperature, liquid water content and droplet size (d).

To measure the temperature some form of sheltered thermometer is used, giving a reading for the ambient temperature. The methods used to determine the two remaining variables can be divided, broadly, into mechanical and optical methods.

The mechanical ways of determining the l.w.c. and d are twofold: the multiple-cylinder method and the rotating disc method. The former is not a direct-reading method, but a comparison of the rate of catch on cylinders of different radii makes it possible to evaluate the l.w.c. and the drop diameter. The rotating-disc method depends on the use of a thin rotating disc, edge-on to the airstream. The thinness of the disc renders the efficiency of catch virtually 100 per cent, and automatic devices are usually used to transmit the thickness of accumulated ice to a dial graduated directly in arbitrary units. The reading, after correction for the T.A.S., represents the liquid water content only, since the effect of the drop size shows itself only in the efficiency of catch.

Optical methods may consist of direct photographs of suitably magnified droplets, either caught on some special surface or else photographed in motion by compensating their movement by a moving arrangement. By utilizing the absorption of light passing through a certain distance in cloud it is possible to determine the l.w.c. with the aid of a direct-reading photo-cell.

Thanks to the pioneer work of M. Glauert (Ref. 6), J. K. Hardy (Ref. 2) and many others, it is possible, knowing the variables mentioned under "Meteorological Factors", to determine with a reasonable degree of accuracy the rate of catch and the heat required to prevent icing. Once the rate of catch is known, it is possible to calculate (in the case of thermal anti-icing), the heat required for complete ice prevention.

Determining the Worst Case

It has to be stressed here that the main uncertainty is the icing case against which to design.

Using the method suggested by the author in Ref. 8, the computations are shortened and, in case of thermal anti-icing, it is possible to determine relatively quickly, the worst icing condition for a given aircraft. Even then, it will be necessary to decide which will be the worst design-case for a given aircraft. For instance, will the climbing case be worst than the descent on reduced power (in the case of exhaust-heat exchangers)? Or will the aircraft have to cruise in icing conditions for any length of time? Very often the one-engine-off cruise is the worst case, owing to the reduced heat or power output and reduced height.

It is to be noted that no protection is required in case of aircraft flying at speeds above 500 m.p.h. T.A.S., since the kinetic heating is then sufficient to prevent accretion in most icing conditions.

It has to be stressed that, if a continuously acting thermal system is used, it is essential to evaporate all the water caught, since any run-back water will eventually encounter an unheated portion of the aerofoil and solidify there. Ice thus formed will then persist, during the remainder of the flight, increasing, often quite appreciably, the drag of the aircraft. This fact is especially important in the case of turboprop or pure-jet aircraft, where the relation between drag and range is extremely critical and where any increase of drag means a drastic cut in range.

Methods of Protection.—The methods of protection can be divided into three classes: (*a*) mechanical; (*b*) chemical; and (*c*) thermal.

The mechanical methods of protection are mainly based on the use of inflatable rubber bags located along the leading edge of the aerofoil. The best known is the Goodrich system, widely used on the Constellations and the Douglas series of post-war airliners. This is essentially a de-icing system and ice is removed periodically by inflating the bags. The central bag is inflated first, which breaks the ice roughly along the leading edge; the remaining two are then operated and the accumulated ice breaks away and is removed by the airstream. The system has its drawbacks, mainly arising from the resulting drag-rise, limited chordwise extent, inability to deal with all types of icing, and vulnerability. It is, however, a working system and has rendered good service in the past.

The chemical method depends on the use of various substances, in liquid or paste forms, which lower the melting point of ice and thus decrease the adhesion between the surface of the aerofoil and the layer of ice. It can be used as a de-icing or anti-icing form of protection. The liquid usually has a proportion of alcohol or glycol and is exuded through a porous leading edge or is guided (in the case of airscrews) along spanwise rubber grooves. The main difficulty consists in ensuring a uniform distribution of the fluid and in preserving the porosity of the leading-edge material in spite of the dust and animal particles encountered in low-altitude flight. Also, the liquid carried to ensure protection during prolonged periods of icing represents a dead load which, to counter an expected one to two hours of icing, can run into 300 to 500 lb on a large airliner. Though systems of this kind now seem to be less favoured by designers, one fluid method—using the new Porosint porous leading-edge material—has attracted attention; a series of tests were made on a Viking aircraft and good results claimed.

The thermal systems can be applied as anti-icing or de-icing arrangements. Since icing is essentially a thermal phenomenon, thermal methods seem to be the logical way of preventing it. They can be broadly divided into systems using electricity as a source of heat and those using warmed gas, such as hot air, air mixed with exhaust gases, or exhaust gases alone.

Electrical Heating Systems

Heating of the aerofoil surfaces by electric current was first developed in Germany during the last war. This method and the new materials developed recently were subjected to an extensive series of tests in England last year, with very satisfactory results. The Canadian Air Research Council has also embarked on an extensive test programme with their specially equipped DC-4M, the *Rockcliffe Ice Wagon*, which toured Britain in September, 1950.

It is considered that the electrical methods now being developed will provide the lightest and most effective way of protecting aircraft against the hazards of icing.

The electrical system is essentially a de-icing form of protection. Aerofoil surfaces are divided into a certain number of sections to which current is applied periodically. Continuous heating is not practicable, since a prohibitive current supply would be required. Periodic heating, and the fact that ice is allowed to form in localized areas, has other advantages, which will be discussed later.

The heating elements, embedded in thin rubber pads, are applied externally and form a certain number of independent circuits covering the leading edge of the aerofoil surfaces. At the stagnation line and at the junctions of the various sections thin strips are provided which are heated continuously and at a slightly higher rate than the remainder of the system. For the equipment to function properly there must be a certain amount of ice accumulated. The current is then switched on, ice begins to melt from the inside, the cohesion between accretion and aerofoil is destroyed and the ice is removed by the airstream.

There are two regions, the primary shedding zone and the secondary shedding zone. The role of the secondary zone, which is cycled at a much slower rate than the primary one, is to remove any ice which might in some icing conditions accumulate past the normal area of catch covered by the primary zone. Its duty is also to get rid of any (usually negligible) run-back which may occur from the primary zone.

The usual dimensions and rates of power supply are as follow:—

(1) Stagnation Line Parting Strip: Width, 1in; Continuous Heating, 12 watts/sq in.

(2) Primary Shedding Zone: Width, 6in on both sides of (1); heating, 8 to 8.5 watts/sq in; usual cycling, 1: 8 (severe icing, 20 sec on, 140 sec off).

(3) Secondary Shedding Zone: Width, 6 to 8in on both sides of (2); heating, 5.5 to 6.5 watts/sq in; cycling, once every 10 cycles of the primary zone.

Rate of Cycling

The cycling can be varied to suit the icing conditions, and very often it is sufficient to cycle at a rate 1: 16. There is a critical relation between the heating and the width of the parting strips. It has been established that the thinner the leading-edge parting strip the shorter the shedding time. The best results have been obtained with an inch-wide strip in the cruising stagnation-point position.

The main problem with electrical de-icing is the choice of suitable heating pads and the provision of satisfactory bonding between the aerofoil and the pad surface. It has been found that pads with rubber forming the external surface stand up to abrasion much better than more resilient plastics (this is specially important in the case of airscrews).

The application of heating pads inside the wing, although giving a cleaner external surface, is less efficient, owing to the fact that the thermal capacity of the skin destroys some of the advantages of periodic heating.

The merits and disadvantages of the electrical methods will be

THE ICING PROBLEM . . .

discussed later, together with the remaining thermal systems.

We may next consider thermal methods using hot gas. With the advent of the gas turbine as a prime mover in passenger aircraft there is a readily available source of heat, either in a direct supply of hot gas or from a surface heat exchanger. For empennage protection combustion heaters are usually employed, since it is inadvisable to have long ducts passing along the fuselage.

The usual arrangement with the wing system is to lead hot gas in a spanwise duct along the wing and then discharge it into some form of small chordwise ducts, formed by double skin or corrugations. (Fig. 2).

The use of undiluted exhaust gases originating from kerosene combustion does not create corrosion problems. A series of tests has been made to that effect by the Tiltman-Langley Laboratories, with positive results. The internal soot deposit does decrease the gas-to-skin heat transfer after a certain time, but at least 100 hours' exposure is necessary before any difference can be detected.

The systems using hot gas or air can offer an excellent degree o protection, but require very careful design-study. They also have several drawbacks, the principle one of which is the fact that they can be designed economically, as continuously operating anti-icing protection, only for continuous maximum icing. In any instantaneous maximum icing condition there will be a certain amount of run-back. The second difficulty is that, although the heat required for distribution can be quite accurately determined, the actual heat supplied is dependent on the gas-flow distribution achieved, which in turn depends on pressure drops in the various components of the system. Pressure-drop is very difficult to determine accurately otherwise than by experiment and is even

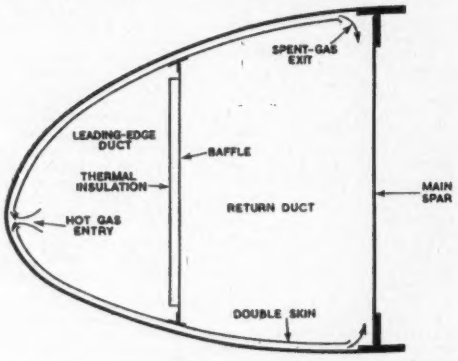

Fig. 2. Typical arrangement of a hot gas anti-icing system for a wing.

difficult to reproduce accurately on various aircraft of the same series.

The leading edge double skinning or corrugations can easily be designed as stress-carrying components of the wing, and a properly designed structure need not be heavier than an orthodox unheated wing. The surface of such a wing can be kept very smooth indeed, a fact of great importance in these days of high cruising speeds. Use of the Redux bonding process must be mentioned in this connection as providing a very satisfactory solution of the problem. Its use, however, requires a careful temperature-control of the hot gases, since any overheating of the structure above 90 deg C may greatly reduce the strength of the bonding.

Relative Merits of the Two Types of Thermal System:—

Chief advantages of the electrical system are as follow:—

(*a*) Ability to deal with *any* icing condition, no matter how severe. It is immaterial to the system how much ice is accumulated on the heating pads; the same small quantity of ice has only to be melted, from underneath, to ensure the breakaway of the deposit.

(*b*) No run-back is formed, even in the most severe icing.

(*c*) In aircraft relying on electricity for most of the auxiliary services there is no need for separate generators, since all the power required can be supplied by the existing generators, because icing occurs in flight, i.e., during the time when the main auxiliary services are not required.

(*d*) Possibility of ensuring accurately the required rate of heating.

(*e*) Lightness of complete installation.

(*f*) Ease of ground checking and fault finding.

The disadvantages are:—

(*a*) Increased drag due to the external heating pads.

(*b*) Further slight increase in drag in icing conditions, since a certain amount of ice will always be present for most of the icing time, due to the periodicity of removal.

(*c*) In aircraft which are not "all electric," it may be necessary to install special de-icing alternators.

The main advantages of the hot-gas systems are:—

(*a*) Very clean aerofoil surfaces are possible and, if the double skin is designed to carry stresses, little or no increase in total weight of wings is possible.

(*b*) All the water caught can be evaporated in continuous icing, which means that no increase in drag will occur in icing conditions.

(*c*) The heat carried by the air in the boundary layer prevents some freak forms of icing farther along the chord, past the usual protected zone.

(*d*) The spent gases can be used to ensure complete freedom from icing in control and flap gaps.

The most serious disadvantages are:—

(*a*) The system can economically be designed for continuous maximum icing. In instantaneous maximum conditions, which usually last a few seconds only, some run-back must invariably occur. If by any misfortune it occurs at the beginning of the cruise, the ice formed behind the protected zone will persist until the final descent, thus increasing the drag and cutting the range.

(*b*) Necessity of evaluating very carefully the pressure drops in the system, many of which will have to be determined empirically. Any manufacturing inaccuracies will alter the designed mass flow.

(*c*) Necessity of providing separate heaters for empennage protection.

(*d*) In comparison with the electrical system, the weight penalty is slightly higher.

(*e*) Relatively long calculations are required to establish the correct heat requirements, pressure drops and mass flow distribution (about 1,000 man-hours are required on a large size airliner) as compared with those for the standard power requirements for the electrical system.

It might be useful to mention that it is sometimes advantageous to adopt a mixed system, where the wings are heated by hot gas and the empennage by electricity.

Conclusions

The following conclusions summarize the main points of the foregoing review:—

(i) The methods of computation available are more accurate than the meteorological data against which the system has to be designed.

(ii) The effect of ice is more pronounced on smaller aircraft.

(iii) No protection is required for airframes of aircraft cruising above 500 m.p.h. T.A.S. The pessimum speed (at which the heat requirements are largest), occurs at about 370 m.p.h. T.A.S.

(iv) Thermal systems of protection seem to provide the most satisfactory way of eliminating the danger of icing.

(v) Hot-gas thermal anti-icing systems can be designed with a high degree of efficiency; they require, however, a precise knowledge of the prevailing continuous icing conditions on the intended routes of the aircraft.

(vi) For turboprop or turbojet long-range aircraft freedom from run-back is essential and the method of protection adopted (if continuous) should ensure complete evaporation of water caught.

(vii) With recently developed materials used on aircraft already having powerful generators for auxiliary services, the electrical de-icing is the lightest and the most efficient form of icing protection.

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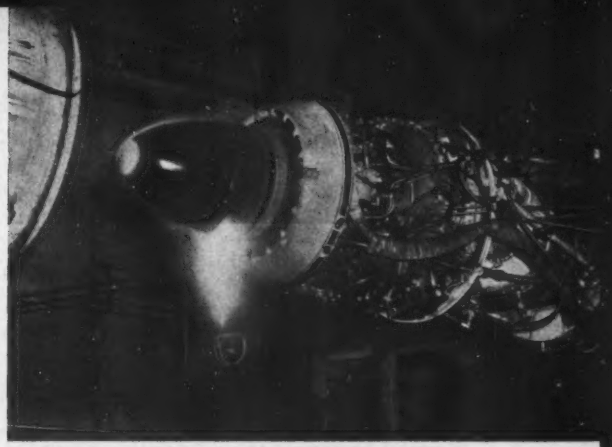
DART ENDURANCE TEST

500 Hours of Simulated Operational Conditions Completed Without Trouble

THE news that the Rolls-Royce Dart turboprop has successfully completed a 500-hour endurance test some twelve months before the Viscount is expected to go into regular service is most satisfying. British European Airways, who gained considerable experience with the prototype Viscount on the London-Paris and Edinburgh routes during the summer of 1950, now also have in regular freight service one Dart-powered Dakota, while another is due for delivery. This Dakota, which started its regular freight service to Hanover on August 15th, 1951, will provide a wealth of information on handling and maintenance of the Dart turboprops. Eventually these aircraft are expected to be transferred to the longer route to Milan.

The reason for the Dart-Dakota combination is to accumulate the maximum amount of information on the Dart prior to introducing the Viscount into regular service, and it must be emphasised that B.E.A. do not propose to modify existing Dakotas to include the Rolls-Royce Dart turboprop. The 500-hour endurance test at Derby, together with the 5,000 total flying hours which have been accumulated, give good grounds for believing that when the Viscount is introduced into scheduled service the power units will be virtually trouble-free. The policy of developing and testing power plants to this degree whenever possible is one of the factors which has given Rolls-Royce the reputation they hold throughout the world today.

The application of Rolls-Royce engines has not, of course, been restricted to military spheres alone. In fact, up to June 31st, 1951, the two-stage Merlin had accumulated 1,169,000 engine hours and the single-stage unit no fewer than 2,615,000 hours in civil operation. In their participation in civil aviation, Rolls-Royce also offer to civilian operators a standard charge for major overhauls, based on the engine hours flown. Operators have found this service very useful and in the majority of cases competitive economically with their own maintenance facilities. A Rolls-Royce overhaul agreement is expected to be extended to the Dart following operational experience with the Viscounts.



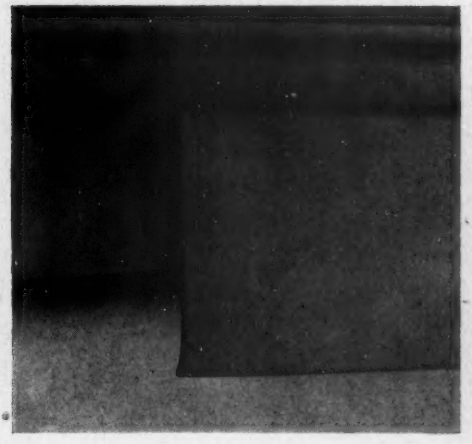
A photograph taken when the Rolls-Royce endurance test was in progress and during one of the rain-injection periods.

Although it has shown irrefutably that the turboprop is capable of a 500-hour operating life without major overhaul, this was not the primary object of the run. With the assistance of B.E.A. a test schedule was compiled to simulate as far as possible conditions which are expected to be encountered by the Viscount during its European service. The routes covered during the test included the normal scheduled service from London to the major European cities. For example, one portion of the test simulated engine requirements during the Rome to London stage as follows :—

	hr.	min.	r.p.m.
Taxi out		6	6,000
Take-off		1	14,500
Climb		42	13,300
Cruise	2	11	13,300
Descent		25	10,000
Approach and landing		5	10,750
Taxi in		6	6,000

The engine speeds used during the endurance run were those recommended by Rolls-Royce for airline operation. The cruise and climb powers quoted for the test are in actual fact appreciably higher than those recommended, because whereas the endurance test was conducted at sea-level conditions, B.E.A. will use the same revolutions which at altitude will give a lower power. The test, therefore, may be regarded as being more arduous than normal flight conditions.

During routine operations it is expected that the Viscount will encounter dust or sand, and therefore to simulate these conditions the engine was subjected to artificial sand storms. Sand was fed into the airstream immediately in front of the engine intake by means of a hopper and calibrated orifice.



(Left) Erosion of the leading edges of the second stage diffuser vanes resulting from the injection of sand. (Below) Circumferential cracking at the weld of the front section.

DART ENDURANCE TEST . . .

A total of two hundredweight of sand passed through the engine. The rate of consumption was 0.03 grams/cu ft, which gave the following :—

	r.p.m.	lb/min
Taxi in and out	6,000	0.26
Orbit	10,750	0.68
Take-off	14,500	1.06

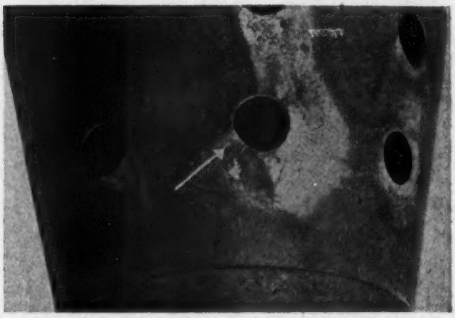
Water was sprayed into the airscrew slipstream and directed at the engine intake at a rate of 150 gall/hr during take-off and 50 gall/hr while taxi-ing, comparable to conditions during a rain storm. The oil temperature was maintained at the maximum permissible (90 deg C) during climb periods for flights at which high oil temperatures are likely to be experienced. In addition, during one representative flight in every 100 hours, the engine was operated with the period of take-off power increased from one to five minutes and with climb and cruise carried out at the maximum continuous conditions. These emergency conditions served to simulate operation with one engine feathered.

With the exception of the flight-type exhaust unit, which was undergoing development, no parts of the engine were replaced during the 500-hour run. Throughout the test, only scheduled maintenance and inspection were carried out and those occupied a total of 46.6 man hours or 0.092 man hours per engine hour.

When the engine was subsequently stripped for inspection, the most outstanding feature revealed was the condition of the combustion equipment. The flame tubes, which had previously run 240 hours, had completed a total of 740 hours and were still recoverable. This figure of 740 hours life for flame tubes must be the highest achieved by any engine manufacturer. The illustration shows the condition of the worst flame tube, and even this one will eventually be salvaged and put into further service.

It is agreed that the problem with flame tubes is to prevent buckling due to the temperature gradient from the head to the skirt, and although cracking and slight buckling has taken place it may be safely said that flame tubes need no longer be regarded as expendable units. The nozzle guide vanes (98 H.P. and 76 L.P.), which are made from H.R. Crown Max, were still fit for further running after 500 hours and only nine H.P. vanes showed signs of minor cracks. This is surprising when it is considered that the operating temperature of the nozzle guide vanes is one of the limiting conditions so far as power and specific consumption are concerned. Except for the leading edges of the second stage diffuser vanes, no damage was sustained as a result of the injection of the two cwt of sand.

To summarize, it may be said that the 500-hour endurance test was completed most successfully and B.E.A. will have not only the first turboprop to become available, but the finest that could have been chosen for the work.



Cracking of the flame tubes around the tertiary air holes.

INDIA'S NEW TRAINER

A Successful First Flight made earlier this month : Cirrus Majors Specified

FIRST aircraft to be designed and built in India, the Hindustan HT-2 trainer, to which brief references have previously been made in *Flight*, is the subject of a description sent to us by an Indian correspondent. The prototype made a successful first flight on August 13th, and a production order for 300 has already been placed.

As would be expected for a machine which is to fly in tropical regions, all-metal construction is employed, and in the design the requirements of the Indian flying clubs as well as the Air Force have been considered. Thus the cost of maintenance is expected to be low, and, for example, sheet stock, simple sections and a conventional two-spar wing construction have been used in preference to extruded sections and elaborate wing form. The wings have a straightforward four-point attachment to the fuselage frames, and are described as easily removable for repair.

The wide temperature variations to be found in India have in the past led to rigging and control problems, and therefore push-pull rods are used in preference to cables for all controls, and special attention has been given to the bearings so that the lightness and "feel" of the controls shall not be impaired. The engine mounting is also described as conventional, although particular attention has been paid to accessibility, and plenty of space has been left between the rear of the unit and the fireproof bulkhead so that work can be carried out on accessories, controls and so on.

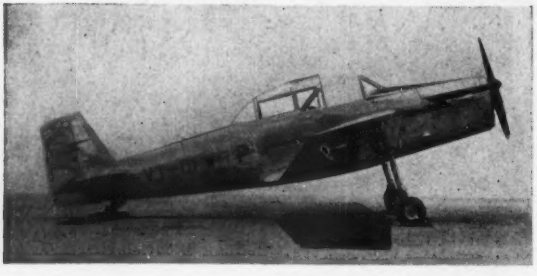
The undercarriage has been designed and manufactured in the Hindustan factory and it has now been decided that on production models hydraulic oleo struts will replace the rubber in compression to be found on the prototype.

All controls are duplicated in the two cockpits, and the front and rear instrument panels are identical. The flaps are operated mechanically from either cockpit and can be locked in any one of three positions. The cockpit enclosure, comprises two separate hinged sections, and a substantial crash pylon is provided for protection in the event of a nose-over.

The HT-2 is fully aerobatic, and is stressed for inverted flight, and the aerodynamic characteristics are described as conforming to standard requirements for a machine of the type. The speed range may be considered average, the extremes being stall with flaps at 47 m.p.h., and maximum sea-level speed, 150 m.p.h. Normal cruising speed at low level is 135 m.p.h., and the rate of climb is 840 ft/min. Absolute range is 500 miles.

Although the prototype is flying with a Gipsy Major 10 engine the decision has been taken to power production trainers with 158 h.p. Cirrus Major 3s.

Our correspondent remarks that India has still to provide for the design and manufacture of engines, instruments and radio equipment before she becomes self-supporting in aviation. It seems that the procedure will at first probably be in the direction of manufacturing under licence the best existing designs from other countries, and this should eventually lead to the design in India of all equipment to meet military and civil requirements.



Conventional design-technique is apparent in the appearance of the Hindustan HT-2 primary trainer.

Dimensions are as follows :

Span	35ft 2in	Flap area	29·3 sq ft
Length	25ft 5in	Root chord	6ft 7½in
Height	9ft 6½in	Tip chord	3ft 8in
Gross wing area ...	173·4 sq ft	Wheelbase	8ft

S.B.A.C. SHOW. FARNBOROUGH 11th—16th SEPTEMBER

The industry's 'shop-window' provides many glimpses of the future and this year, more than any other, the chance of 'seeing round the corner' will be provided by The AVRO 707 A & B. Watch the flight demonstration, note the manoeuvrability, estimate the speed range and study the simplicity of line. And, as you watch the little AVRO 707 climbing away to, perhaps, five or six thousand feet, remember that only a delta will go on to upwards of 40,000 feet and yet still retain near sonic speed, a high degree of manoeuvrability and an unsurpassed economy of operation.

A. V. ROE & CO., LTD., MANCHESTER (Member of the Hawker Siddeley Group)

During the measurements of emergency take-off distances with the production Ambassador at maximum weight the docile handling characteristics shown on repeated below-safety-speed engine-cut checks fully supported the promising results obtained with the prototypes. The Ambassador's asymmetric qualities, both on the ground and in the air, are outstanding for a twin-engined aircraft

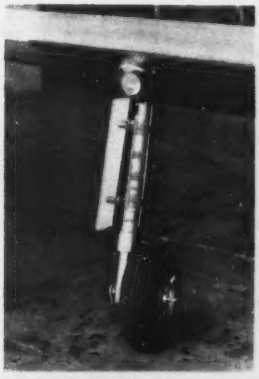
AMBASSADOR

BRITISH EUROPEAN AIRWAYS' *Elizabethan* CLASS AIRLINER

AIRSPEED DIVISION OF THE DE HAVILLAND AIRCRAFT COMPANY
CHRISTCHURCH, HANTS, ENGLAND

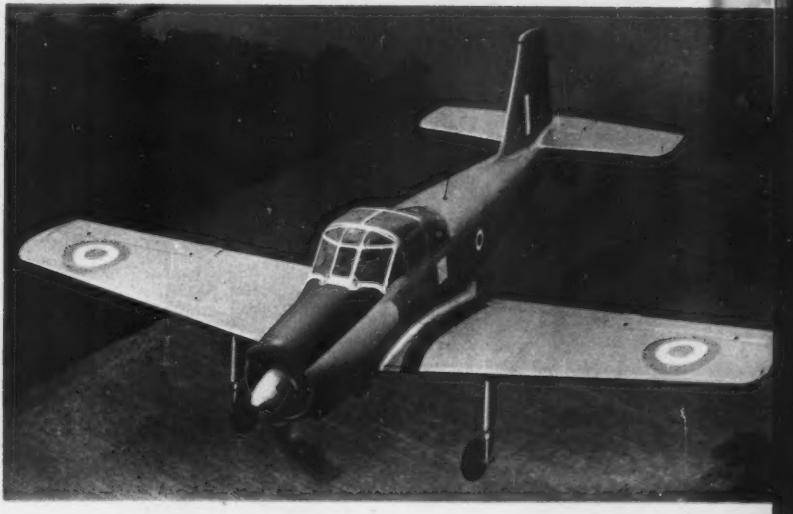
SCHOOLING THE PROVOST

Development of the R.A.F.'s New Basic Trainer Proceeds



The new aerial views above and below show the Mk 2 Provost—a not very photogenic machine—at its best. WE 530 carries the latest Service markings. The details right are of the hinged fairing giving access to the oleo leg, and the engine installation revealing exhaust system and oil tank.

"Flight" photographs



WORK on the Percival Provost basic trainer is making good progress, and recently two examples, one with Alvis Leonides and the other with Armstrong Siddeley Cheetah power unit, completed their tropical trials. Although the Mk 2 Leonides version is going into production for the R.A.F., the Mk 1 will be kept alive in order to be ready should foreign buyers with experience of Cheetahs have reason to prefer the older and cheaper engine.

Reports of handling trials at Boscombe will give the Provost an excellent send-off on its Service career, and improvements suggested are not only of a very minor nature, but had in the main been incorporated even before the reports were received by the makers. Development and testing continue.

It seems that separate throttles and pitch levers are no longer required by pupil and instructor in their side-by-side seats, and so production machines will have single levers on the central pedestal.

It is the general opinion that instructors and pupils alike will enjoy handling this lively basic trainer, and that its straightforward flying characteristics will instil confidence in pilots from their earliest flights.

VALIANT

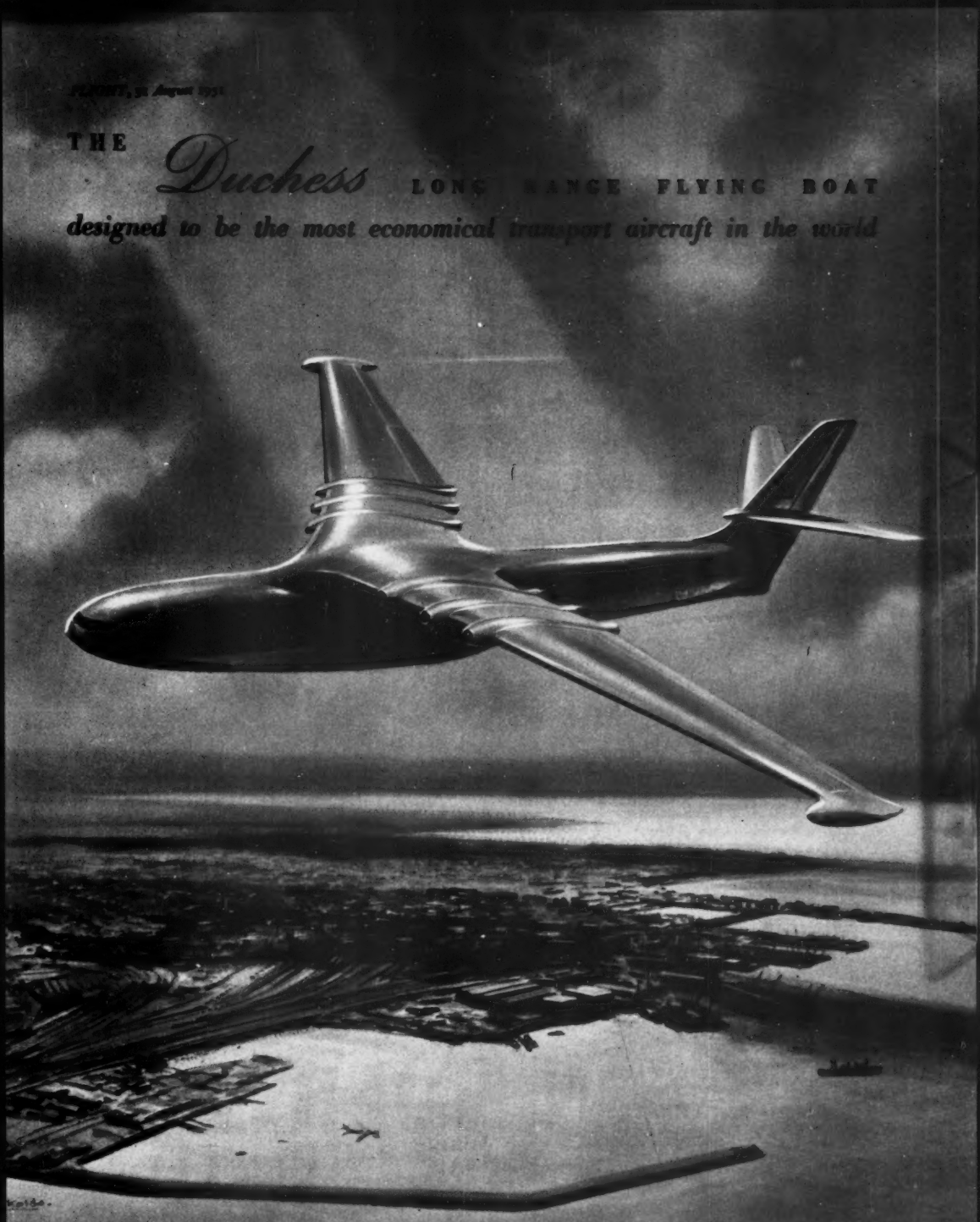
"'Tis still observed," wrote Emerson, "those men most valiant are, Who are most modest ere they come to war." Certainly no one could accuse the R.A.F., the Ministry of Supply or Vickers-Armstrongs, Ltd., of over-assertiveness in respect of publicity for the Avon-powered Valiant jet bomber, the newest aerial studies of which are reproduced here. Little can be said of their splendid machine beyond that which can be learned from the photographs. The Secretary of State for Air, however, has assured the nation that, according to his information, it will be superior to the twin-jet English Electric Canberra (a type pre-eminent in its own class) in range, speed, altitude and load-carrying capacity.

THESE characteristically spirited impressions by Russell Adams are among the first air-to-air shots of Gloster's private-venture ground-attack Meteor, developed from the Mk 8 fighter-bomber. They show the newly introduced wing-tip fuel tanks and 24 rocket projectiles—one of numerous load-combinations possible with this remarkably adaptable single-seater. In a semi-mock-up state the P.V. Meteor was statically exhibited at the S.B.A.C. Display last year.

ROCKETEER

THE *Duchess* LONG RANGE FLYING BOAT

designed to be the most economical transport aircraft in the world



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THE AERONAUTICAL BOOKSHELF

Some Recent Publications Reviewed

Mechanism of Victory

"Calculated Risk," by General Mark Clark. George G. Harrap and Co., Ltd., 182, High Holborn, London, W.C.1. Illustrated. Price 22s. 6d.

THE reader of a book at this price is entitled to expect something fat and satisfying, and he gets it in *Calculated Risk*. It is big in size—478 pages, 27 half-tone illustrations, 30 maps drawn by General Clark's daughter, plus a recommendation by General Eisenhower—and it has a great story to tell, of how a polyglot but united army of British, New Zealand, Indian, Polish, Brazilian, South African, Palestinian, Italian and American troops fought and destroyed 25 German divisions in some of the toughest, least publicized battles of the war.

General Clark is immensely proud of the achievements of his Fifth Army and, later, 15th Army Group, which included the British Eighth Army; and he loses no opportunity of saying so. There is never any doubt of his sincerity, personal courage and ability, and one can forgive his oft-expressed delight when promotion and medals came his way, or to his colleagues.

Proponents of air power will, however, not be enthusiastic over the General's views on air support. He pulls no punches in his criticism of the work of the Allied Air Forces at Anzio, and, although he records later that "The Air Force played a tremendous role in the victories that led to the liberation of Rome," he emphasizes again and again that aircraft used for support of ground troops "are necessarily auxiliary weapons, as is the artillery, and they should come under the direct orders of the ground commander. That, in a sentence, is still my belief today."

General Clark's beliefs are important, as he is now Chief of the U.S. Army Field Forces. *Calculated Risk* proves that his qualities and experience well fit him for his task. They include close contact with Russian leaders in the field and over the conference table, and his report of a post-war conversation with Marshal Konev explains in a nutshell present international chaos. After a typically abortive meeting he said to the Russian, "You've made ten demands at this Council meeting that we can't meet. But suppose I should say, 'All right. We agree to all ten demands.' Then what would you do?" "Tomorrow," replied Konev, "I'd have ten new ones."

Raising the Dust

"Was I Really Necessary?" By Richard Williams-Thompson. World's Press News Publishing Co., 20, Tudor Street, London, E.C.4. Price 10s. 6d.

"MIKE" WILLIAMS-THOMPSON was chief information officer to the Ministry of Supply from 1946 to 1949, and here is his story of one of those jobs which demand the qualities of a superman.

A public relations officer in a government department in these curious times finds himself perpetually walking a very thin tightrope with a great deal of empty air beneath it—and no net. At one and the same time, if he is to complete his performance, he must contrive to please the Service Chiefs, who are prone to consider Fleet Street as a high-speed espionage route to the country's potential enemies; Fleet Street itself, which in one sense is his principal reason for existence; and the more diehard type of Permanent Civil Servant, who, wrapped cosily in a cocoon of red tape, is inclined to take a dim view of the direct methods of senior officers and keen newspapermen alike. Added to this, the P.R.O. must resist the constant temptation to become a personal publicity agent for his particular Minister, for politicians have an odd propensity for becoming fallen idols overnight.

That Williams-Thompson avoided all these pitfalls during his tenure of office is a tribute to his personality, which emerges very clearly in this book. As the field which he had to "relate" to the public was so vast—he himself calls the M.O.S. the "Ministry of Army Boots to Atoms"—the aviation side of the story is only one of many. Nevertheless, his chapter entitled "The Conflict of the Air" is a quite fascinating revelation (even to an aviation journalist) of what goes on behind the politico-industrial scene when important new civil and military aircraft arrive, so to speak, in the maternity ward.

His analysis of the unhappy affair of the Tudors is particularly detailed and penetrating. He apportions the blame between (*a*) the Cabinet, "for its failure to grasp the fundamentals [coupled] with the fact that the Minister of Supply was not strong enough to see that it did"; and (*b*) the Ministry of Supply for its failure to put the whole story before the public.

"If it were too late to do anything for the Tudors," says Williams-Thompson in his summing-up of this section, "it was certainly not too late to improve the Ministry's position generally with the Press." He then goes on to tell how he set about doing so. That he succeeded admirably we ourselves can bear witness; moreover, he simultaneously did a good deal to convince the Service side of the Air Ministry and M.O.S. that Fleet Street was not entirely peopled with secret agents. Writing of the regular Press conferences instituted soon afterwards, he says: "Much of the discussion was on secret and confidential matters, and the Press never once abused the confidence they were shown."

Not everybody, even outside official circles, will agree with all the views expressed in this forthright little book; but its author will undoubtedly have stirred up some breezes in Whitehall corridors that badly needed airing.

The Loser Speaks

"We Defended Normandy," by Lt.-Gen. Hans Speidel. Herbert Jenkins, Ltd., 3, Duke of York Street, London, S.W.1. Illustrated. Price 12s. 6d.

THIS book was published without the fanfares of trumpets that have heralded so many personal histories of World War II; yet it is among the most interesting, because it is the first authoritative German criticism of Axis and Allied strategy and leadership in the war's decisive battles.

Inevitably, Hitler is the villain of the piece, but, as General Sir Henry Pownall admits in his very fine foreword to the book, the Fuhrer was well cast for that role. His obstinate blindness, fostered by contempt for his commanders and sublime confidence in his own intuition, made ultimate defeat certain, although the German Army was still a great fighting machine in 1944. Had it been withdrawn from the Atlantic Wall, Channel Islands and Southern France and concentrated somewhere north of the Seine, to fight a great battle on ground of its own choosing, the outcome might well have been less catastrophic. But Hitler refused to listen to the advice of his generals and his armies were destroyed piecemeal.

Speidel was Chief of Staff of German Army Group B, which opposed the Allied D-day landings in Normandy—a position he retained for the first three critical months, under Rommel, von Kluge and, finally, Model.

He leaves little doubt of the effects of Allied air power on the battle. The Luftwaffe apparently had only some 70 bombers and 90 fighters available on D-day; and they were pinned down so effectively that the German High Command ordered that "every aircraft in the sky is to be treated as an enemy machine." Speidel further comments on the "uncanny precision in co-operation between the Allied land forces and their air and naval support."

The General's own record shows him to be a capable, humane soldier and a scholar—qualities which mark him as a possible future chief of a German defence contingent within the Western Union armed forces. This fact makes his book even more worthy of serious study.

Heathrow Helpmate

"The Airport Visitor." Penman Enterprises, Ltd., 59, Croham Road, South Croydon, Surrey. Illustrated. Price 1s. 6d.

THIS little book is intended as a companion and guide for all who part with their shillings to see aviation at close quarters from the public enclosures at British airports. It opens with a message from Sir John D'Albiac, commandant of London Airport, then gives details of London, Northolt, Squires Gate, Prestwick and Speke; lists of all British airfields; pictures and brief details of most types of airliner commonly seen in the United Kingdom; two pages on "Miss Airways 1950—the search for the perfect airline girl"; caricatures by Wren of eight types of civil air liner; illustrated notes on airport-control equipment; a logbook giving the registration numbers, names and owners of 700 airliners serving this country; notes on various British and foreign airlines and pictures of the insignia of 12 of them.

There is little doubt that *The Airport Visitor* will help the average member of the public to gain maximum pleasure and interest from a few hours at an airport; but future editions will benefit from more careful editing. For example, a misplaced line of type gives the Ambassador a 115ft cabin and the Argonaut an all-up weight of only 52,000 lb; the Convairliner is called variously "Convair Liner," "Convair 240," "Convairliner 240" and "Consolidated Convair 240," which must confuse the uninitiated; and the "British Airlines" section omits such companies as Airwork and Huntings from its brief list of charter firms. Nevertheless, the basic idea is excellent, and *The Airport Visitor* is good value for eighteen pence.

THE FIRST OFFICIAL AIR-MAIL

Some Personal Recollections of an Historic Experiment of Forty Years Ago

By HARRY HARPER

OFTEN in these modern times, when I receive a letter by air from Australia in a matter of days, my thoughts go back to a couple of history-making summer afternoons. On one of them—it was in August, 1910—I happened to be sitting in a shed on the Squire's Gate flying-ground at Blackpool (yes, it was an airfield even then!). In front of me was a little aluminium portable typewriter—one of the first of its kind—on which I was tapping out a letter to my wife.

Outside, on the aerodrome, stood a Blériot monoplane. Quickly I finished my letter, and after sealing it I ran across to the monoplane, beside which stood that well-known air transport pioneer, G. Holt Thomas, and that equally well-known pioneer pilot, Claude Grahame-White.

That letter of mine, with others and a lot of postcards, went into a bag which was stowed away in the cockpit. After which "G.W." took his place at the controls and, in spite of a gusty and troublesome wind, flew with the bag for seven miles across country, alighting at a spot not far from Southport. Here the load passed into the hands of waiting postal officials, and its contents went on to their destinations through ordinary surface channels, each piece of postal matter bearing an inscription in red to testify that it had actually been airborne.

Although that Blackpool test was quite unofficial, it had the distinction of being the first of its kind in this country. It also served the purpose which its organizer, Mr. Holt Thomas, had in mind, and this was to illustrate the then just-dawning possibilities of the aeroplane as a carrier of mails. Actually it did something more, for it paved the way for those now-famous officially sponsored trials organized in September of the following year, 1911, which were flown over a 20-mile route between the London Aerodrome at Hendon and Windsor Great Park.

Held in connection with the celebrations attending the Coronation of King George V., this experiment, (during which more than 100,000 letters and cards were carried) has already been the subject of a number of articles, and references in books. Details of the flights are, for example, well-known to all who are interested in the collection of historical air-mail matter.

So far as I am concerned, it was my privilege to be on the spot at the time, and to watch and describe the inaugural and concluding flights. And as we now near the fortieth anniversary of these historic proceedings, it seems appropriate to indulge in a few personal recollections, the more so as the organizer of the whole affair, the late Sir Walter Windham, was an early air friend of mine.

It was he who managed to interest the then Postmaster General, Sir Herbert Samuel, to such an extent that official Post Office sanction and co-operation was accorded to the trials—the first time it had ever been given in connection with any such aeronautical experiment.

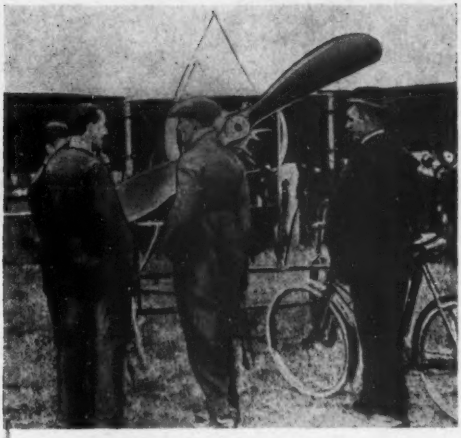
Gustav Hamel in the cockpit of the Blériot monoplane in which he inaugurated the mail flights by carrying from Hendon to Windsor a letter addressed to King George V.

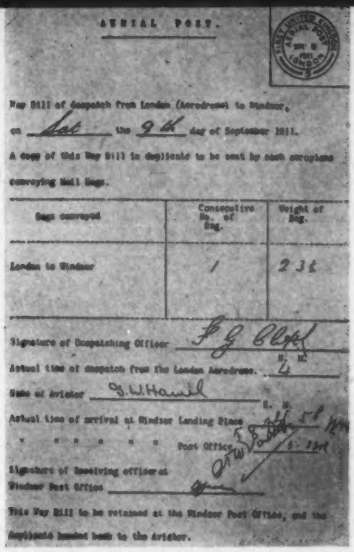
Ladies in the big picture-hats of the period post letters at Hendon for dispatch by the first British officially-sanctioned air-mail, between Hendon and Windsor, September, 1911.

One of my recollections of this aerial milestone is of visiting some of the big London stores, just before the actual flights, and of seeing in each of them the novel sight of a bright red air-mail pillar-box. These boxes, of course, were the first of their kind to appear in the metropolis. In them, members of the public posted specially issued letters and postcards, each of which carried a coloured pictorial design showing an aeroplane flying over Windsor Castle, and bearing the words "First United Kingdom Aerial Post." All these letters and cards had already been franked for inland postage with 1d. stamps for the letters and ½d. stamps for the cards, while the special additional air transport fee was 1s. 1d. for letters and 6½d. for the cards.

These pillar-boxes were to be found in prominent positions in nine of London's principal stores, including Harrods, Whiteleys, Selfridges, and Gamages, and I can recall an official at the last-named establishment telling me that before the first flights from Hendon they had already sold approximately 25,000 letters and cards. There were more of the boxes out on the aerodrome at Hendon.

Collections from the London boxes were made at regular intervals by Post Office vans, and the letters and cards were





AERIAL POST.

Way Bill of despatch from London (Aerodrome) to Windsor,

on Sat the 9th day of September 1911.

A copy of this Way Bill is duplicate to be sent by each aeroplane conveying Mail Bags.

Bags conveyed	Consecutive No. of Bag.	Weight of Bag.
London to Windsor	1	23 lb

Signature of Despatching Officer F G Cloyd

Actual time of despatch from the London Aerodrome. 4 P.M.

Name of Aviator G. L. Hamel

Actual time of arrival at Windsor Landing Place 5.15 P.M.

" " " " " Post Office 5.19 P.M.

Signature of Receiving officer at Windsor Post Office

This Way Bill to be retained at the Windsor Post Office, and the duplicate handed back to the Aviator.

The central figure in the photograph above is that of Clement Greswell, the pilot who flew the first mail-load in the return direction, i.e., from Windsor to London. (Right) Post Office waybill of the mail-bag carried by Gustav Hamel on the inaugural flight.

then taken out to Hendon for transport to Windsor by monoplanes and biplanes which were provided for the tests by the Grahame-White Company. Four pilots were entrusted with the flying of the mails. They were Gustav Hamel, Clement Greswell, E. F. Driver, and Charles Hubert. Hamel and Greswell flew Gnome-Blériot monoplanes, and Driver and Hubert, Gnome engined Farman biplanes.

The highlight of the whole business came on the opening day, September 9th, when Hamel inaugurated the flights by carrying to Windsor a bag of special mails, including a letter from the organizers to his Majesty the King.

We had all gone out to Hendon that morning, being due to lunch on the aerodrome before the dispatch of the first machine in the afternoon. But already there was a factor to be reckoned with over which neither we nor anybody else had any control—the weather; and what the experts were telling us was already causing anxiety.

What was happening was that a quick-moving and deepening depression had appeared suddenly off our south-west coast, and was now moving across southern England. This meant that the wind was already blowing in awkward gusts by the time we reached the aerodrome. Of course, there was nothing in it to worry any pilot of today, but conditions were likely to be distinctly troublesome for anyone flying one of the low-powered, slow-flying machines of forty years ago.

What was worrying everybody more than anything else was the fact that, being officially recognized, this experiment had already received so much advance publicity that interest in it had been thoroughly aroused. And this meant that if the inaugural flight had to be abandoned there was the obvious risk that quite a lot of people might start saying that the aeroplane was not a sufficiently reliable means of carrying His Majesty's mails. And such an impression, if it took early root, might be very detrimental to plans already under discussion for the establishment of regular air-mails.

So we were a somewhat preoccupied group as we assembled for that aerodrome lunch, more especially as we could see, looking out across the aerodrome, that the weather continued to deteriorate. There was one of the party, however, who remained quite cheerful. This was Gustav Hamel, destined within the next hour or so to win enduring fame by becoming Britain's first official flying postman.

Gustav was one of, if not the, finest monoplane pilots of his day, fully capable of holding his own with the very best of the French champions. Not content with flying in favourable weather, he had already begun to make experimental flights in quite high and gusty winds.

As zero hour approached, gusts of over 40 m.p.h. were being recorded. Hamel, however, still remained quietly confident, shaking his head emphatically at any idea of postponing or abandoning the flight.

Mechanics wheeled out his Blériot. The mail-bag containing the Royal letter was placed in the fuselage. The Gnome was run up and, as Hamel gave the signal, his mechanics let go, and he taxied out and took off.

Just as the monoplane was climbing an exceptionally heavy gust came sweeping across the aerodrome, and the little machine literally seemed to come to a standstill in the air. Then, the gust dying away as quickly as it had come, we saw the monoplane swerve and begin to dip a wing. For a moment it looked perilously like the beginning of a spin into the ground. But Hamel still remained master of the situation. Diving quickly to pick up speed, he got the wing up just in time, and then we watched him battle his way up until he reached a higher, steadier air-stream.

At Windsor the waiting officials, in view of the adverse weather, had already almost given up hope of seeing any aeroplane coming from the direction of Hendon. But suddenly, from below a heavy cloud-bank, there appeared the tiny speck of Hamel's monoplane. As he drew nearer, coming down over the tree-tops, gusts were seen to be throwing the little machine about like a row-boat in a heavy ground-swell. But by cool and clever piloting he managed to make a safe landing. Instead, however, of coming down on the East Lawn of Windsor Castle, as had been arranged, he flew on beyond the Castle and alighted in the Shaw Farm meadow, near the Frogmore Mausoleum. Here postal officials on bicycles soon reached him, and he handed over his bag containing the Royal letter.

In the official timing of the flight, Hamel's take-off from Hendon was given as 4.58 p.m., and his landing on the Shaw Farm meadow as 5.13 p.m. Actually he was timed to pass over Windsor Castle at 5.11 p.m., and he told me afterwards that he calculated he had reached a ground speed of over 100 m.p.h.—evidence enough of the strength of the tail-wind.

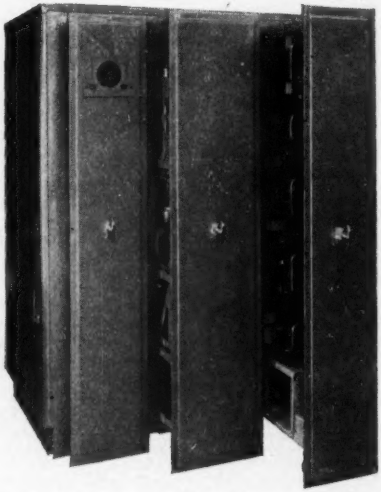
The first official mail to be flown into London from Windsor was carried by Clement Greswell, who wrote to me not long ago, recalling some of the incidents of these Hendon-Windsor trials. Altogether, in the flights made between September 9th and 26th, 1,015 lb of mails were airborne, and a total mileage of 720 was flown.

One unfortunate accident marred what was otherwise a remarkably successful experiment. Hubert crashed while taking off from Hendon in one of the biplanes, and had the misfortune to break both his legs. It was this accident which led to a one-day "strike" among the other pilots, who were insisting on an immediate grant of a sum of £500 to Hubert, by way of compensation, out of the proceeds accruing to the promoters from the sale of letters and cards. As soon as this could be arranged, the flights continued. After the granting of this £500 to Hubert, there was found to be a sum of £937 remaining after the organizing expenses of the flights had been met; and this final amount was used to endow a "Coronation Aerial Post" bed in the King Edward VII hospital at Windsor.

Distance-measuring Equipment

The Operation of an Internationally Approved Short-range Navigation Aid

The distance/homing meter is a standard-sized cockpit instrument. The distance scale is logarithmic, 0-200 miles being covered by one revolution. "Homing" appears on the lower half of the face; indication is of the "chase-the-needle" type.



This cabinet, shown with bays partially withdrawn, houses a complete responder beacon, together with an automatic monitoring system.

IN 1946 a meeting convened by the Radio Technical Division of the Provisional International Civil Aviation Organization, after considering all available navigational aids, agreed that the system which should be standardized along the world's air routes must determine distance and bearing from a pre-determined point and present it directly to the pilot. This functional requirement was supplemented by the decision to adopt distance-measuring equipment, or D.M.E. as it is now usually termed, as a fundamental component of any such system for short-range navigational purposes.

At that time only the overall characteristics of the required D.M.E. had been worked out; long and detailed study was required before an internationally agreed specification could be laid down. This study was carried out, and the results discussed at international aviation meetings during the succeeding years. Finally, in June, 1951, the Fourth Session of the Communications Division of I.C.A.O. agreed the full specification for the D.M.E. that should be installed along the international air routes.

It might be supposed that, with the international specification agreed only in June last, the development of equipment to meet the specification might be delayed for many months. In fact, the progress made towards the implementation of D.M.E. is such that the de Havilland Comet, on its scheduled service to the Middle East on the London-Rome-Cairo route, will be using D.M.E. before the end of this year. Beacons are being installed at each stopping point, the London installation being directly associated with the V.H.F. omni-directional range, or V.O.R., which provides the bearing component of the complete system. The Comet's equipment, developed and manufactured by Ferranti, Ltd., has been subjected to a series of flight trials over the last two years involving 240 hours of operation in the air.

To cater for areas in which V.O.R. equipment may not be available or required—as, for example, in the Middle East—the D.M.E. equipment has a built-in homing facility. This makes D.M.E. by itself a complete system capable of guiding any aircraft directly to a selected beacon.

At present a variety of navigational aids are in use in different parts of the world, and many of them are available only in limited areas. At first sight it might appear to be satisfactory for one country to adopt an internal-flying system differing from that specified for international use, but examination of the problem shows that the number of airline operators whose activities are confined to one limited area is extremely small; for example, in Europe only 25 per cent of the scheduled operators' aircraft are employed on feeder services. Further, to international operators the disadvantage of carrying equipment in their aircraft which is only of regional use cannot be overstated. Quite obviously, such a state of affairs is both inefficient and uneconomic, but the work of I.C.A.O. has opened the way to overcoming it.

A primary operational requirement of a short-range navigational system is that it should provide for the pilot information regarding distance and azimuth from a geographical point. The information must be presented to the pilot visually and continuously. The combination of D.M.E. and V.O.R. provides such a fixing system and the information is given in such a way as to tell him what action to carry out in order to reach his destination. In many circumstances information of this nature will be of much greater value than a knowledge of the actual position of the aircraft, from which action to be taken has to be deduced.

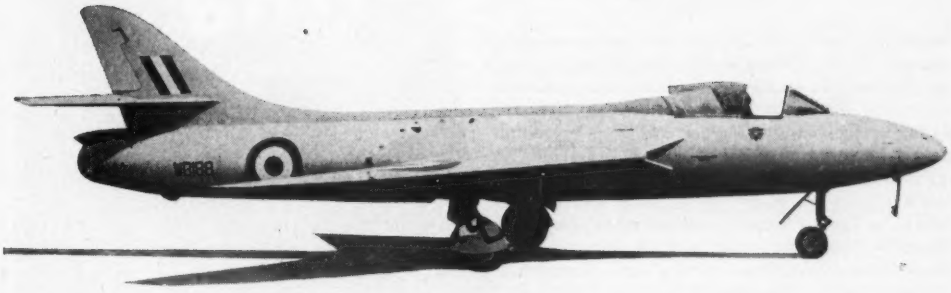
A further operational requirement is that the equipment must be capable of being used in areas of high traffic and airfield density.

As its name implies, distance-measuring equipment provides range to a given point. There are two components—an airborne interrogator and a ground beacon. The interrogator transmits a characteristic signal to the beacon which, in turn, transmits a characteristic reply. On receiving this reply, the interrogator measures the elapsed time between the transmission of the interrogating signal and the receipt of the reply. As the propagation of high-frequency radio waves takes place in straight lines at a practically constant speed, this time interval is an exact measurement of the distance travelled by the signal, and therefore of the distance of the aircraft from the beacon. This measured distance is displayed continuously to the pilot, and any other crew member, on a meter, as range in nautical miles from the beacon. The displayed accuracy is plus or minus half a mile, or 3 per cent—whichever is the greater—up to a max range of 200 nautical miles.

The 1,000 mc/s band is used for D.M.E. This has the advantage of being unaffected by cloud or rain conditions and, as the frequency is too high for ionospheric reflection, accuracy is the same both day and night.

To avoid any confusion of the identity of a ground installation, which might arise in areas of high beacon-density, 100 unique channels are provided for allocation to beacons, and all of these are available in the interrogator. Any one channel may be selected instantaneously and automatically by the pilot. The chances of receiving replies from the wrong beacon are thus extremely small provided that the correct channel number is chosen and that the initial allocation of channels has been done with care. In addition to this frequency-channelling, provision is made for an aural identification signal to be fed *via* the D.M.E. system to the intercommunication system of the aircraft. Where V.O.R. and D.M.E. installations are combined, the identification signals from each are synchronized so as clearly to indicate the association. If no V.O.R. is present, the signal is distinctive.

A beacon is housed within one cabinet, which also contains



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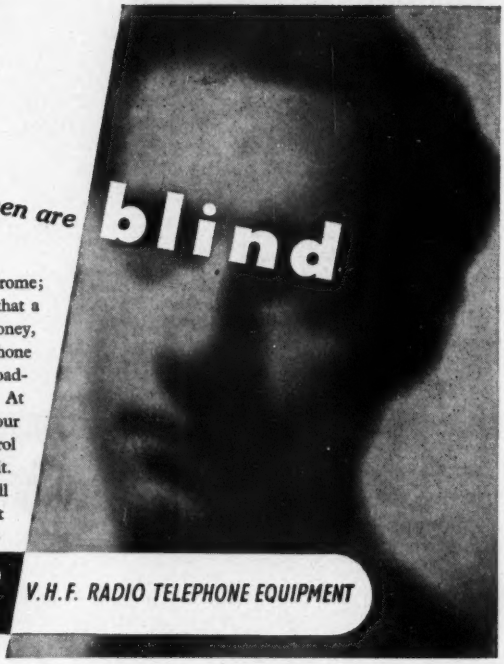

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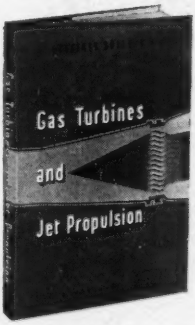

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DISTANCE-MEASURING EQUIPMENT...

a monitoring system. This monitoring system automatically and continuously checks such characteristics as transmitter power output, receiver sensitivity and timing accuracy. A full installation is planned to consist of two complete beacons, each with a monitoring system, together with main and stand-by power supplies. In the event of any falling-off in performance or failure of this beacon, the second beacon will automatically come into operation and replace it. Similarly, a power failure will bring in the stand-by power source. These features make the beacon entirely automatic in operation and suitable for installation at a point distant from an airfield if necessary and unattended apart from routine maintenance visits. Remote-control facilities are provided for switching on, and an indication of failure, should one occur, is given at the control point. When considering the system for world-wide use, the fact that the complete ground installation (combined with the associated V.O.R., if any) is housed within one building is patently an advantage. There may be difficulties in maintaining and protecting an interdependent chain of ground installations, for the elements of such a chain may be many miles apart in isolated or uncivilized areas. Furthermore, a ground installation of the beacon type is comparatively inexpensive to provide and requires fewer technicians to maintain.

Interrogator Control Unit. Channel selection is by the two rotary switches near the centre; the channel number appears in the windows between.

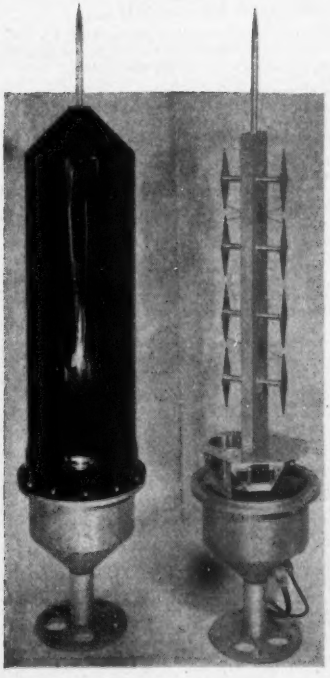
The beacon aerial consists of a vertical array mounted on a mast normally 30ft high. The complete array is housed in a Fibreglass dome. Coverage of the aerial can be predicted from a knowledge of the geographical contours in the neighbourhood of the site.

The airborne equipment consists of three main assemblies, a transmitter, a receiver and a timing unit. These are housed in pressurized containers which permit the equipment to be installed, if so desired, outside the pressurized portion of the aircraft. Three aerials are provided and these are of the suppressed type, i.e., they are completely enclosed within the skin of the aircraft so as to avoid drag. An omni-directional or "distance" aerial is normally mounted in the lowest portion of the aircraft fuselage and two homing aerials are installed in the nose to give forward cover. A range of non-suppressed aerials is also available for particular applications.

A control unit is provided for the pilot, with an additional unit for the navigator if desired. The unit controls channel selection, which follows automatically on the setting of the channel number on two rotary switches. Two distance/homing meters supply the information to pilot and navigator. The meter display adopted is logarithmic, with an open scale at the shorter ranges at which the most precise information is likely to be required. This type of scale enables the full range of 0-200 miles to be presented in one revolution, so that unambiguous readings can be obtained at a glance. The homing facility gives the pilot, on a centre-zero instrument incorporated in the distance meter, an indication of whether the beacon is to port or starboard of the aircraft, with a rough indication as to the amount of turn necessary to bring the beacon ahead. It has been established, state the makers, that satisfactory homings can be performed in cross-wind conditions.

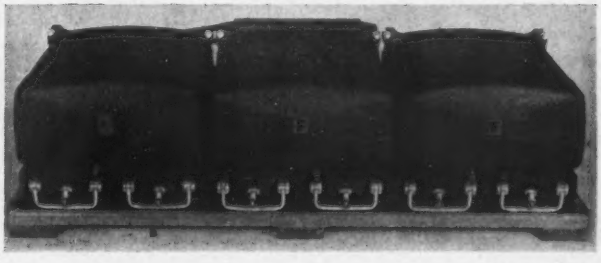
Further developments towards a complete navigational system on the 1,000 mc/s band are a method of aircraft identification in conjunction with surveillance radar, the provision of bearing information, and an off-set computor. It is proposed to cover all these facilities without requiring additional frequency allocations in the 1,000 mc/s band. Trials at London Airport have shown the feasibility of an identification system using the airport ground radar as an interrogator and the D.M.E. transmitter as a responder. Bench trials have also been successfully carried out on a bearing system making use of the existing receiver circuits of the D.M.E., together with an additional bearing discriminator unit. A model of a mechanical computor has been made which gives every indication that this can be made both small and accurate.

It has already been stressed that the subject of navigational aids cannot be judged nationally; any realistic and worthwhile examination of the problem must be carried out on an international basis. Turbine-powered aircraft cover great distances and may cross continental frontiers. The fact that their fuel consumption is high at low altitude means that the time taken for the let-down to the destination must be kept to a minimum period by the use of a suitable aid. The appearance of these aircraft on the world's air routes underlines the importance of an internationally accepted system.



(Left) The beacon aerial, shown on the right with dome removed. Provision is made for the fitting of standard obstruction lights.

The three identical main units of the interrogator—transmitter, receiver and timing unit



FROM ALL QUARTERS

Folland Aircraft Changes

FROM Folland Aircraft, Ltd., comes the announcement that G/C. J. Noakes, A.F.C., M.M., has resigned from the company and that G/C. S. O. Tudor, D.F.C., has been appointed senior liaison officer as from August 20th. G/C. Tudor has been representative of the Society of British Aircraft Constructors, Ltd., Far East, since 1946. He had a distinguished war-time career with Bomber Command.

The New Italian Air Attaché

DURING his tour of duty in this country as Italian air attaché, Col. D. S. Fanali has made many friends among the aviation community. A keen pilot, he has led Vampire delivery flights to Italy and, incidentally, was instructor to Signor Ferrari, who was to pilot an Ambrosini S.7 originally entered for the *Daily Express* Race. Col. Fanali has now returned to Rome, where he has been appointed to a post in the Italian Air Ministry.

Col. C. F. de Porto

His successor is Col. C. F. de Porto, who has had a distinguished record with the Italian Air Force, in which he was commissioned in 1931. At the outbreak of war he was a major, and flew operationally in the Mediterranean area, gaining two silver medals for valour and a Military Cross. In 1941 he was promoted to command the 29th Bomber Squadron. Towards the end of the war, when air attaché in Bucharest, he was interned by the Germans, but returned to Italy in 1945. In the following year he was given command of the "Baltimore" wing of the I.A.F., and in 1948, as a colonel, he received a staff appointment. Col. de Porto, who has flown about 2,400hr, is married and has a 13-year-old son. He is fluent in four languages besides his own—English, French, Spanish and Roumanian.

Speeding-up Administration

MR. W. R. VERDON SMITH, assistant managing director of the Bristol Aeroplane Co., Ltd., is to open the South-Western Business Equipment and Management Exhibition at the Victoria Rooms, Bristol, on September 25th. The exhibition is being organized by the Office Appliance and Business Equipment Trades Association, the representative body of the office equipment industry.

A feature of the show will be a variety of sound-recording machines, among which will be one measuring only 4½ in. by 9½ in. by 12½ in., introduced by the firm that some time ago installed the equipment at Northolt and London Airports for recording R/T. conversations between aircraft crews and control towers. The office machine records both sides of a telephone conversation.

Also of interest to airport operators will be visual-control installations for showing aircraft-maintenance progress, terminal-building intercommunication equipment, electric typewriters which will make twenty carbons in one operation, and duplicators which switch themselves off automatically after the exact number of copies required have been run off.

Swedish Turbojets

SWEDEN entered the aircraft gas-turbine field at an early stage, and the name of Professor Lysholm will always be associated with some ingenious pre-war designs. Facilities were, however, limited, and de Havilland Goblins in an advanced state of development became available for purchase and production under licence before Sweden could develop a turbojet of her own. Originally two development contracts were placed by the Swedish Air Board, one with S.T.A.L. for an axial compressor unit, and the other with Svenska Flygmotor Ab, with which company Lysholm was working. Both were to give about the same thrust as the Goblin. Today the Swedish Goblin production order has been almost completed by Flygmotor, and Ghosts are coming through for the Saab J-29 fighter. Flygmotor and S.T.A.L. have pooled resources in order to speed the development of a new large axial turbojet to replace Ghosts in some later J-29s and possibly for other machines to follow.

One of these S.T.A.L.-designed axial units has been installed below the fuselage of a Lancaster flying test-bed, and an illustration appeared in *Flight* of July 6th. The work was done in England by Air Service Training of Hamble, and the aircraft, known in the Swedish Air Force as the Tp80, was delivered a few weeks ago. Mr. Peter Fowler of the Air Service Training was the pilot for the delivery flight, and he was accompanied by a Swedish engineer and two other crew men—one Swedish, one British. The route taken was from Hamble to Hamburg, Hamburg to Angelholm, and from there to the destination, Malmen/Malmslatt, 20 miles south-west of Stockholm. Flight development is now proceeding.

Turbomeca Licence for America

A LICENSING agreement has been signed between the Stratos division of the Fairchild Engine and Airplane Corporation and the Turbomeca concern for the building and selling of the Oredon turboprop, designed and manufactured by the French company. This new unit, exhibited at the last Paris show, delivers 160 h.p. at the shaft. Incidentally, F. G. Miles is known to be interested in the possibilities of Turbomeca units in this country.

At the Radio Show

AS a contribution towards the British Radio Show, which is now taking place at Earl's Court (August 28th to September 28th) the Ministry of Civil Aviation is exhibiting a 14ft x 8ft scale model of London Airport as it will appear when the present development plan is completed. It is, in fact, the exhibit that was shown at the Paris Salon earlier this year.

A number of radio manufacturers are also showing items of aviation interest, although, naturally, most of them will be concentrating their main exhibits of this kind at the forthcoming S.B.A.C. Show at Farnborough.

S.B.A.C. Scholarships and Grants

THE Society of British Aircraft Constructors announces the following names of students and apprentices to whom educational awards have been made under its scheme for the purpose:

University Scholarships

Continuation Awards.—D. Howe, R. C. Wallin and G. R. Jones to continue at College of Aeronautics, Cranfield; G. A. Sellars and J. J. Cripps to continue at Imperial College.

New Awards.—J. F. H. Goddard (Hawker Aircraft, Ltd.) and J. D. Mann (Blackburn and General Aircraft, Ltd.) to go to College of Aeronautics; R. A. Saunders (de Havilland Engine Co., Ltd.) to go to Imperial College.

Educational Grants

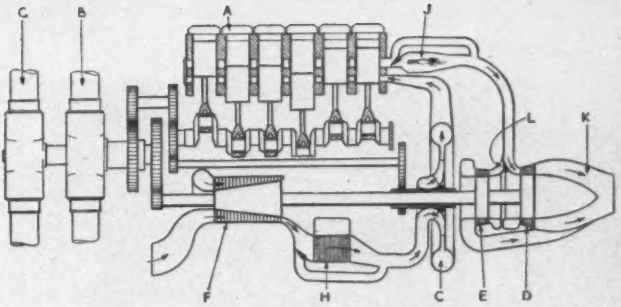
C. W. Hicks (awarded the John de Havilland Scholarship) to serve his apprenticeship with Saunders-Roe, Ltd.; B. M. L. Rampling, to serve his apprenticeship with Handley Page, Ltd.; W. H. Corner, to serve his apprenticeship with the Airspeed division of the de Havilland Aircraft Co., Ltd.; J. W. Sowerby (Vickers-Armstrongs Ltd.), to continue his training with the company; B. H. A. Summers, to serve as a student apprentice at the de Havilland Engine Co., Ltd.

FORTHCOMING EVENTS

Aug.	31.	Helicopter Association: "Operational Employment of the Piasecki Helicopter," by F. N. Piasecki. Lecture followed by Fifth Annual Dinner.
Sept.	1.	R.N. Air Stations Gosport and Lee-on-Solent: Air Display.
Sept.	2.	A.B.A.C. Summer Convention.
Sept.	3-7.	R.Ae.S. and I.Ae.S.: Third Anglo-American Aeronautical Conference, Brighton.
Sept.	3-8.	British Interplanetary Society: International Congress on Astronautics.
Sept.	9.	Society of Model Aeronautical Engineers (Northern Area): Model Flying Festival.
Sept.	10.	R.Ae.S.: 39th Wilbur Wright Memorial Lecture—"The Well-tempered Aircraft," by A. E. Raymond.
Sept.	10-16.	Battle of Britain Week.
Sept.	11-16.	S.B.A.C.: Flying Display and Exhibition, Farnborough.
Sept.	15-16.	International Rally, Parme, Biarritz, France.
Sept.	22.	*Daily Express* South Coast Air Race, Shoreham.
Sept.	25.	Milan International Grand Prix.
Oct.	4.	R.Ae.S.: Seventh British Commonwealth and Empire Lecture, "Air Transport in New Zealand and the South Pacific," by A. V-M. Sir L. M. Isitt, R.N.Z.A.F.
Oct.	21-28.	Aero Club of Algeria: Tour of Algeria.
Oct.	31.	R.Ae.C.: Jubilee Ball.

COMPOUNDED POWER-UNITS

Original Design or Adaptation : A Representative Example by Napier



Layout of a Napier project for a compounded power unit with two-stroke compression-ignition engine and reheat chamber.

THE announcement that the 3,000 s.h.p. Napier Nomad compounded engine will be shown and flown at Farnborough, will no doubt cause a number of prospective visitors to take stock of their knowledge of such designs. Although information about the Nomad itself is restricted, several patents taken out by the Napier company give a good indication of the principles which have been in mind and the types of design under consideration and development.

First, it may be as well to point out that certain compounded units to which reference has been made since the war, and which emanate almost entirely from America, differ, from the Napier conception in being adaptations of existing large piston-engines. They have represented, in fact, no more than the addition of small turbines which, when incorporated in a modified exhaust system, can be used either to produce additional power to drive an extra supercharger or to feed back power, *via* gearing, to the crankshaft of the main piston-engine. In this way something is gained that would otherwise have been lost in the exhaust and some claims of remarkable economy have been advanced for engines with this kind of compounding.

In contrast, Napiers some time ago set about developing a compounded unit which was designed as such from the start, and which has no points in common with the American adaptations—except, perhaps, the heading to the specifications : "Improvements on or relating to internal combustion engine power plants."

It is our purpose here to draw attention to what has already been described and not to guess in any way at design details—still secret—of the Nomad. A representative description of the Napier intention is as follows :—

"The power plant is of the general type in which an internal combustion engine operating on the two-stroke cycle produces gases utilized primarily to act on a turbine which drives a compressor and also an airscrew, the power then available as surplus being used in the internal combustion engine to drive a second compressor and a second airscrew through the engine crankshaft."

This may be enlarged upon in the case of one representative design by adding that the two-stroke combustion engine is of the compression-ignition type. The first airscrew is disposed with its axis parallel to the axis of the engine crankshaft, from which it is driven through gearing. The compressor delivering air directly to the piston engine—by which in turn it is driven—is of the centrifugal type. The second compressor, of the axial type, is driven by and mounted on the same shaft as the main turbine. When this turbine is operative the axial compressor provides a constant flow of supercharged air to the engine-driven centrifugal compressor. The second airscrew, which is driven through gearing from the turbine, is co-axial with the engine-driven airscrew.

In the fifth edition of our well-known text-book, *Gas Turbines and Jet Propulsion**, the following description of operation, with the illustration above, is to be found : The reciprocating engine A, operating on the two-stroke cycle with compression ignition, drives through gearing at the forward end an airscrew B arranged with its axis parallel to the engine crankshaft. A centrifugal compressor C at the rear is driven from the forward end of the crankshaft by means of a torsionally flexible shaft and gearing. The gases produced by the engine are delivered to a duplex turbine unit having main and secondary rotors, D and E respectively, mounted on a common shaft. An extension of the turbine shaft passes through the hollow impeller shaft of the centrifugal compressor to drive the axial flow compressor F and, in turn, through suitable gearing, the co-axial airscrew G. Air delivered by the axial compressor is passed through an intercooler H before reaching the centrifugal compressor and arrangements are made whereby the cooler may be by-passed or alternatively the supply of coolant may be varied.

"Between the engine and the turbine there is arranged a combustion chamber J into which fuel may be injected and burnt. A duct may be provided to by-pass the chamber or the exhaust gases may traverse the chamber at all times and control be effected by regulation of the supply of fuel.

"The main flow of the gas is directed through turbine D and then issues as a jet with reactive effect from nozzle K. A valve L enables some portion of the gases to be diverted as and when desired and passed through the secondary turbine E to supplemen the power developed by the main turbine in driving the axial flow compressor and the airscrew."

**Gas Turbines and Jet Propulsion*, by G. Geoffrey Smith, M.B.E., Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 21s (by post 21s 9d).

THE SABRES ARRIVE

TWENTY-FIVE F-86 Sabre jet fighters of the 116th Fighter Intercepter Squadron, U.S.A.F., arrived at Shepherd's Grove, near Bury St. Edmunds, on the afternoon of August 27th. The last lap of their delivery flight—made *via* Goose Bay, Greenland and Iceland—was from Stornoway to Shepherd's Grove and took about 1¼ hours in the face of strong headwinds. The arrival was witnessed by a large crowd and as the Sabres were touching down a U.S.A.F. band was playing. The R.A.F. provided a guard of honour. Colonel R. J. Garrigan, the Group Commanding Officer, was welcomed by Major-General Leon Johnson, Commanding 3rd U.S. Air Force, A. V-M. C. E. M. Guest, Assistant Chief of Air Staff (Operations), and A. V-M. the Earl of Bandon, A.O.C., No. 11 Group.

The 116th Squadron is a National Guard unit (equivalent to an R.Aux.A.F. squadron) mobilized for active service in February; it is a component of the 81st Fighter Intercepter Wing, which has been assigned for duty in Great Britain for an indefinite period. The Squadron Commander is Colonel Frank W. Frost.

Welcoming the pilots, Maj.-Gen. Johnson said that the U.S.A.F. and R.A.F. worked so closely together than an American would hardly know he was in a foreign country. The only difference was in speech, but words like sincerity, honesty and integrity were common to both nations.

ATOMIC-ENERGY CHIEF

IT was announced in London last week-end that the Minister of Supply has appointed Lt.-Gen. Sir Frederick Edgeworth Morgan, K.C.B., as Controller of Atomic Energy, with effect from Oct. 1st.

General Morgan has had a distinguished Army career, and in 1944-45 was Deputy Chief of Staff to the Supreme Commander, A.E.F. He is the author of a notable book, *Overture to Overlord*, on the planning of the invasion of Europe.

DEATH OF A. CDRE. MAYCOCK

IT is with regret that we have to record the death, in Stockholm on August 21st, of A. Cdre. R. B. Maycock, O.B.E., who had been British Air Attaché there.

Born in 1886, Richard Beachamp Maycock entered the Royal Navy in 1913 and transferred to the R.N.A.S. in 1915. He received a permanent commission in the R.A.F. in 1918, and retired with the rank of air commodore in 1935, afterwards joining Handley Page, Ltd. During his R.A.F. service he was Assistant Air Attaché, then Air Attaché, in Buenos Aires, from 1931 to 1934.

At the outbreak of war, A. Cdre. Maycock was recalled, and occupied the post of S.A.S.O. in Nos. 15 and 17 Groups, Coastal Command. In September, 1941, he was appointed to the Stockholm Attaché post, an important and responsible one which he occupied with distinction throughout the war years.

THE BOSS: Although he has now been in office for several months, it has become apparent that Britain's present Minister of Civil Aviation, Lord Ogmore, while an inveterate traveller is yet apt to shun publicity. We count ourselves fortunate, therefore, in having obtained these two informal photographs of him. He is seen on the left with members of the Air Transport Advisory Council during a visit to the Channel Islands and, at the foot of this column, chatting with Capt. R. A. E. Jones, who commanded the Hermes which took him to Nairobi, where he represented the United Kingdom at talks concerned with the defence of South Africa.

U.S. PASSENGER-TRAFFIC RECORD

RECENT statistical reports suggest that the volume of airline traffic in the United States is, for the first time, approaching that of Pullman traffic on the American railway system. Last year the internal airlines flew a total of nearly 8,000,000,000 passenger-miles and it is believed that by the end of this year the total should be about one-third higher.

Pullman travel in 1950 totalled 9,340,000,000 passenger-miles and is expected to improve by 15 to 20 per cent this year. Passenger revenue for the 16 major trunk airlines in 1950 reached $430,000,000 (about £153,500,000), and was already ahead of the Pullman total of $303,800,800 (about £108,500,000). Before the 1939-45 war, the regular airlines were carrying only about one-eighth of the Pullman traffic; in 1946 the percentage was 23 per cent and it has been rising ever since.

The sharp increase in travel which has helped to improve airline results in this spectacular fashion is attributed mainly to the Korean war and to the U.S. re-armament programme. Also it is thought that the efforts which have been made recently to promote "off-season" traffic and the development of the "coach" services have undoubtedly had a marked effect on the overall results. Certain individual companies have indeed made remarkable progress in smoothing out seasonal fluctuations. It is reported, for example, that in June—generally a slack month for traffic to Florida—Eastern Airlines carried more passengers than in January (normally the peak month) by offering low-cost "all-expense" tours. T.W.A. also discounted their customary winter slump by offering similar flights to the south-western States.

The fact that many companies are now acquiring first-class equipment—such as DC-6Bs, with their increased payload—is also a contributory factor in producing high revenue. Although the "coach" services are developing rapidly and are now being offered over 11 heavily travelled routes, they still constitute a relatively small part of the airlines' total traffic. Most of the big companies offer only one or two "coach" flights a day, as compared with 10 to 15 normal scheduled services.

CIVIL AVIATION

DURING the coming month Great Britain is to be the scene of two congresses of outstanding importance in the air-transport world, aside from another important meeting—the Third Anglo-American Aeronautical Conference of the R.Ae.S. and I.Ae.S., reference to which is made elsewhere in this issue; and at this conference at least three papers of direct concern to airline operators are to be read.

The two events to which we refer here are, first, the Seventh Annual General Meeting of the International Air Transport Association and, secondly, the Commonwealth Air Transport Conference.

It has now been officially announced that the I.A.T.A. meeting will be opened by the Prime Minister, the Right Hon. C. R. Attlee, M.P., on September 10th. Sir Miles Thomas, chairman of B.O.A.C. and I.A.T.A.'s president-elect for the forthcoming year, will take office at the plenary session on the first day.

The discussions themselves will take place from September 10th to 14th and will constitute the first full assembly of I.A.T.A. to be held in the United Kingdom since 1936. More than 150 representatives of over 60 of the world's international airlines will be present; and in most cases delegations will include the chairmen and managing directors of the companies concerned. The meeting place is to be the ancient hall of Westminster School in London.

A glance at the provisional list of visitors reveals the names of such true pioneers of civil aviation as Juan Trippe, W. Hudson-Fysh and Dr. Albert Plesman. We are certain that everybody concerned with British airline operation will join us in welcoming them, for while the destinies of international air transport are in the hands of men of this calibre, and guided by the spirit of mutual co-operation and goodwill which enables such a wide exchange of views to take place, we need have little doubt about the future prosperity of the industry.

A day has, of course, been set aside in the programme to enable the delegates to visit the S.B.A.C. Show at Farnborough, where they will be able to assess at first hand the value of this country's contribution to the technical side of air-transport development.

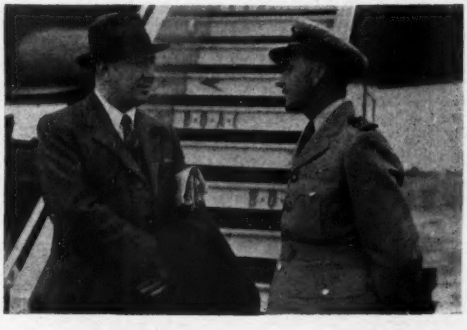
Then, from September 25th to October 5th, following the I.A.T.A. Assembly, there will be the conference of representatives of all Commonwealth (including Colonial) Governments to examine the present state of air transport organizations throughout the British Commonwealth. Particular attention will be paid to the problems of air traffic control arising from the introduction of turboprop and turbojet aircraft on routes running through British territories.

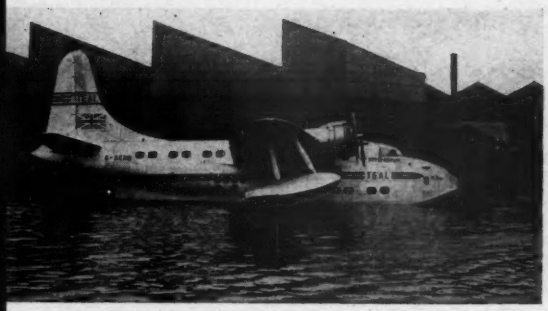
The conference will be under the chairmanship of Air Chief Marshal Sir Frederick W. Bowhill., G.B.E., K.C.B., C.M.G., D.S.O., Chief Aeronautical Adviser to the Minister of Civil Aviation; the session will be opened by Sir Arnold Overton, K.C.B., K.C.M.G., M.C., Permanent Secretary to the M.C.A.

AIRLINE "ASSOCIATE" APPLICATIONS

THE Air Transport Advisory Council, which advises the Minister of Civil Aviation on applications made by independent companies to operate scheduled air services under Associate Agreements with the British Corporations, will shortly consider applications for services to be operated in the period commencing 1952. The Council has requested that applications for these services should reach them before September 17th next, and points out that any received after that date will have to be considered on their merits in the light of any recommendations which may have already been made for the route in question.

Lord Ogmore and Capt. R. A. E. Jones, of B.O.A.C. (see caption above.)





T.E.A.L.'s new Solent "City of Belfast" photographed shortly before take-off on its recent delivery flight to New Zealand.

T.E.A.L.'s SOLENT FLEET INCREASED

ON Wednesday, August 22nd, a newly overhauled Solent left the Belfast works of Short Brothers and Harland, Ltd., on the first stage of a delivery flight to New Zealand. Appropriately named *City of Belfast*, the aircraft is to go into service with Tasman Empire Airways, Ltd. On its journey to New Zealand it will follow a route *via* Castle Archdale, Gander (Newfoundland), Norfolk (Virginia, U.S.A.) then down the east coast of America to Corpus Christi (Texas), San Francisco, Honolulu, Canton Island, Fiji, and thence to New Zealand. The 1,800 n.m. stage from Castle Archdale to Gander will be completed in one flight, while the 2,096-mile hop from Honolulu to Canton Island will also be a direct flight. Normally, aircraft bound for Australia choose the Middle East route. T.E.A.L. already use four Solents on services between New Zealand and Australia.

An interesting sidelight on this flight is that *City of Belfast* will in effect, be following the trail blazed by other Short-built flying-boats which, before the war, established the first commercial passenger service across the North Atlantic. These were, of course, the famous "C" Class flying-boats, and it is perhaps not generally appreciated that such a service was actually in operation at that time.

HEAVY TRAFFIC IN BRITISH GUIANA

THE spectacular increase in the traffic results of British Guiana Airways last year—as revealed in the recently published annual report—is said to have exceeded even the company's most optimistic expectations. In view of the fact that, during the past two years, most of the major mining concerns which provided the bulk of the payload traffic have closed down, it was thought that the company would have experienced a sharp fall in the available volume of traffic. In practice, however, B.G.A. have been able to record progress to such an extent that it now seems possible that the airline may soon be able to operate on a self-sufficient basis, i.e., without the assistance of the annual subsidy paid by the Colony's Government.

The most spectacular rise was seen in freight traffic, the volume of which, at 3,730,550 lb, exceeded that of the 1947-48 peak year by about 200 per cent. This healthy outlook in B.G.A.'s affairs is thought to be indicative of progress now being made in the development and expansion of communications in the interior—progress which has given the necessary impetus to industry in the remote areas of the Colony. Three industries in particular—balata, beef and tobacco—have contributed the bulk of the airline's freight traffic during the past financial year. The company operates a fleet of Dakotas.

BRITISH AIRWAYS OPERATING STATISTICS FOR APRIL, 1951

(Figures for the corresponding period of 1950 *are given in parentheses)*

	B.O.A.C. All Areas	B.O.A.C. Western Area	B.O.A.C. Eastern Area	B.O.A.C. South American Area	B.E.A. All Divisions	B.E.A. Continental Division	B.E.A. British Division	B.E.A.'s Associates
Usable capacity ton-miles	15,416,816	3,440,205	9,246,328	2,233,448	4,768,709	3,772,016	996,693	178,646
	(11,913,449)	(2,264,077)	(7,348,134)	(2,169,106)	(4,108,002)	(3,207,323)	(900,679)	(160,307)
Revenue load ton-miles ...	9,716,775	1,975,060	6,749,456	992,259	2,933,745	2,381,045	552,700	85,037
	(6,597,711)	(1,220,354)	(4,642,597)	(734,760)	(2,374,655)	(1,869,369)	(505,286)	(40,610)
Overall rev. load-factor ...	65.1	57.0	73.0	44.4	61.8	63.3	56.0	47.6
	(56.0)	(53.9)	(63.2)	(33.9)	(57.9)	(58.4)	(56.2)	(25.3)
Available seat-miles ...	98,487,524	25,342,979	58,184,690	14,959,855	39,133,701	30,388,718	8,744,983	992,360
	(72,992,284)	(17,574,081)	(41,801,964)	(13,616,239)	(32,760,878)	(24,037,380)	(8,723,498)	(1,011,126)
Revenue pass.-miles ...	58,861,143	14,433,278	38,303,801	6,124,064	24,700,946	19,405,609	5,295,337	641,851
	(40,253,955)	(8,636,225)	(27,471,435)	(4,146,295)	(20,249,951)	(15,125,676)	(5,124,275)	(350,753)
Rev. load-factor (pass.) ...	59.8	57.0	65.8	40.9	63.1	63.9	60.6	64.7
	(55.2)	(49.1)	(65.7)	(30.5)	(61.8)	(62.9)	(58.7)	(34.7)
Total a/c-miles	2,742,994	441,223	1,644,316	402,632	1,980,520	1,445,910	432,315	55,161
	(2,502,928)	(345,363)	(1,434,795)	(453,254)	(1,670,843)	(1,180,956)	(414,398)	(100,105)
Revenue a/c-miles ...	2,542,177	427,040	1,612,287	397,514	1,840,763	1,424,505	416,258	55,161
	(2,190,091)	(329,212)	(1,400,654)	(436,284)	(1,569,381)	(1,166,284)	(403,097)	(100,105)
Revenue passengers ...	19,039	5,016	11,323	2,700	77,901	48,612	29,289	1,252
	(13,953)	(2,695)	(8,723)	(2,750)	(68,364)	(39,255)	(29,109)	(1,879)
Cargo (tons):								
Mail	210.4	31.6	156.6	22.2	494.3	832.9	197.6	1.7
	(156.0)	(30.7)	(109.0)	(16.3)	(371.8)	(590.8)	(114.4)	(0.3)
Freight	582.9	113.2	392.1	77.6	1,085.4	296.7	252.5	411.7
	(372.8)	(58.1)	(255.4)	(59.3)	(790.3)	(257.4)	(199.5)	(186.1)
Total revenue hr ...	11,366	1,736	7,382	1,774	11,960	8,614	3,346	459
	(10,201)	(1,359)	(6,741)	(1,984)	(10,496)	(7,128)	(3,368)	(778)
Total non-revenue hr ...	1,081	81	159	30	1,026	140	138	—
	(1,623)	(92)	(136)	(89)	(769)	(100)	(110)	(—)
Equivalent annual utilization (rev.hr per a/c) ...	2,064	—	—	—	1,681	2,111	802	—
	(1,401)	(—)	(—)	(—)	(1,447)	(1,837)	(1,001)	(—)
Percentage regularity ...	99.9	100.0	99.9	100.0	97.4	96.8	98.1	100.0
	(98.3)	(97.2)	(99.0)	(96.9)	(98.1)	(98.1)	(98.2)	(100.0)
Unduplicated route-miles	69,673	8,074	45,997	15,602	17,020	14,229	2,791	2,092
	(70,052)	(6,911)	(46,113)	(17,028)	(13,151)	(10,344)	(2,807)	(3,298)
Average stage flight (miles)	1,125	1,570	1,086	970	244	360	118	144
	(1,081)	(1,338)	(1,084)	(938)	(222)	(358)	(112)	(121)

IN April, 1951, the United Kingdom Airways Corporation carried substantially more traffic than in the corresponding month of the previous year; nearly 13,000,000 short ton-miles were flown at an overall revenue load-factor of 64 per cent. These figures can be compared with 9,000,000 short ton-miles and a load-factor of 56 per cent for April, 1950.

Most of the results for both airlines show marked increases over last year's figures, particularly so far as passenger traffic is concerned. B.O.A.C. recorded over 58,000,000 passenger-miles—a 46 per cent rise, and only slightly less than the record month of September, 1950. The passenger-miles flown in the Eastern, Western and South American Areas increased by 39, 67 and 48 per cent respectively.

In B.E.A.'s international passenger traffic results the sharp seasonal rise which appeared in March was seen to continue throughout April. In the Continental Division alone 19,000,000 revenue passenger-miles were flown, as compared with 16,000,000 in March and 15,000,000 in the previous April.

It will be seen, also, that the amount of freight and mail carried by companies operating under associated agreements with B.E.A. was much greater than in the corresponding month of last year; the actual percentage increases for freight and mail ton-miles flown were 120.1 and 246.4 per cent respectively.

It should be noted that the short ton of 2,000 lb is now being used by the M.C.A. in compiling these tables, instead of the long ton unit (2,240 lb) which was previously employed.

PREVIEW DELIVERY: On August 22nd R.M.A. "Elizabethan," the flagship of B.E.A.'s new Airspeed Elizabethan fleet, was delivered to London Airport by Mr. G. B. S. Errington, the manufacturers' chief test pilot. The aircraft has been officially loaned to B.E.A. for a short period for training purposes. In the left-hand photograph Mr. Errington can be seen handing over the ship's papers to Capt. C.E.F. Riley, D.F.C., Flight Captain of No. 8 (Elizabethan) Flight. Mr. Gordon Marshall, also of Airspeeds, is the man with the "Delivery-day" smile.

CIVIL AVIATION . . .

ITALY'S AIR-TRANSPORT DIFFICULTIES

IT was reported from Rome last week that the Italian Government has appointed a committee of inquiry to investigate the critical state of affairs now obtaining in the field of commercial aviation in Italy. One statement says that the committee has been detailed to report whether, bearing in mind the need for State assistance, it is in the country's interest to "have civil aviation at all." Taken at its face value this sounds rather sweeping, and we can only presume that the real purpose of the inquiry is, in fact, to decide whether further participation by the State in the Italian air transport industry is justified.

For some time now it has been apparent that grave difficulties have faced Italy's two major airlines, mainly owing to lack of Government support. It seems unlikely that, without further national subsidies, the two principal companies, Alitalia and L.A.I., can continue to operate their present schedules; and, as there is little likelihood of sufficient capital being subscribed locally to enable them to carry on as independent undertakings, it is conceivable that the present foreign shareholders (B.E.A. in the case of Alitalia and T.W.A. for L.A.I.) may be offered the opportunity of taking a greater financial interest in the two airlines.

Incidentally, on August 20th, Alitalia reintroduced its services between Rome and London, using 44-seat DC-4s, on an initial schedule frequency of twice weekly. The service was originally started in 1947 with S.M.95s and was temporarily suspended on February 7th last.

JAPANESE INTERNATIONAL SERVICES?

AN unconfirmed report from Tokyo contains the information that Japan is planning to introduce international air services once the forthcoming Peace Treaty has been signed. September 8th is mentioned as the tentative date for the signatories to convene for this purpose. In *Flight* last week we reported the progress to date with the formation of a foreign-controlled domestic airline to run Japanese internal services. This latest report intimates that regular services to Indonesia, Karachi and San Francisco would constitute the first routes of the proposed international operations, for which, incidentally, the Japanese Transport Ministry has suggested the use of Super Constellations. It is understood that assurances have been obtained from Japanese heavy-industrial interests that the construction of such aircraft can be undertaken locally under licence "in order to avoid placing unfair demands on the American aircraft industry."

The U.S. might be willing to sponsor and equip the international airways project, which could probably be represented as part of the American plan for Japanese development in South-east Asia.

Looking ahead to the possible effects of the rebirth of civil aviation in Japan on this scale, it does not seem likely that Australia would view the scheme with much enthusiasm in view of the fact that her own operator, Q.E.A., is known to be desirous of including Indonesia in its present schedules between Japan and Australia. Eventually, also, Australia might be faced with demands that Japan be accorded reciprocal rights for services to Australia in exchange for the present Qantas rights to serve Japan.

RANGE TESTS ON D.M.E.

AS indicated in the article on distance-measuring equipment on pages 258-259 of this issue, Ferranti, Ltd., have to date completed the installation of two of the three D.M.E. beacons which are to be located, respectively, at London Airport, Rome and Cairo. D.H. Comets should therefore be using D.M.E. on scheduled services to the Middle East before the end of this year.

The beacons at London and Rome have already been tested in a series of flight trials in which a specially equipped DC-3 has been used. In view of the fact that these are the first installations in Europe to be designed specifically for civil aviation, the results of the calibration tests are of particular interest. From London Airport four tracks—north, south, east and west—were flown, and the ranges obtained varied from a minimum of 24 n.m. (at 1,000ft on a northerly heading) to a maximum of 115 n.m. (at 10,000ft on a westerly heading). Ferranti have stated that the results achieved at London agree with the theoretical ranges which were calculated on a "line-of-sight" basis, taking into account the contours of the terrain surrounding the beacon.

The results achieved so far with the Rome beacon have been characterized by a wide variation in range, particularly on oversea tracks. One figure of 78 miles obtained at 1,000ft was considerably greater than the estimated maximum, and it is thought that these excessive ranges may be the result of the super-refraction effect first noticed in the Mediterranean area during the war.

When the Cairo installation becomes operational and the Comets begin their flights on this route, it will then be possible to obtain information on the high-altitude coverage of these beacons.

BREVITIES

A RECENTLY published M.C.A. Information Circular states that, because of a temporary shortage of certain maintenance items, it may not be possible, until further notice, to provide G.C.A. facilities at British airports unless ten minutes' prior notice is given. To assist in conserving spares, also, only limited facilities for practice "talk-down" approaches will now be offered.

* * *

To give a practical demonstration of the benefits of using helicopters on inter-city feeder services, Westland Aircraft, Ltd., last week made a series of demonstration flights with an S-51 between Manchester, Bradford, Leeds and Sheffield. The passengers included many officials of municipal authorities. A total of 22 flights were scheduled between Ringway and Yeadon airports and the Balfour Sports Ground at Sheffield.

Despite the present trend of rising costs, Tasman Empire Airways, Ltd., have shown a profit of £16,591 on their operations in the past financial year. After interest on loan capital has been paid the net profit will be £781. The company now has an annual turn-over of £1,000,000 for operations over a route network of 8,549 miles.

* * *

Aquila Airways is believed to be the first of the British independent companies to adopt an aircrew salary-scale corresponding with that of B.O.A.C. and B.E.A. As in the newly revised Corporation rates, captains will receive increments according to seniority. Aquila, it will be remembered, operates Hythe flying-boats on the Southampton-Lisbon-Madeira route—a service which has proved extremely popular, especially with holiday visitors.

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CIVIL AVIATION . . .

A B.O.A.C. Constellation recently broke the commercial aircraft speed "record" for the 2,000-mile hop from Darwin to Sydney; its average speed was 328 m.p.h.

* * *

At a cost of almost £250,000 the terminal building and facilities at Glasgow's Renfrew Airport are to undergo improvements which, it is hoped, will be completed by next May.

* * *

Capt. "Mike" Pearce of Central African Airways has retired from his post as the company's superintendent of flying. After having logged some 2,000,000 miles in the air, he is giving up flying altogether.

* * *

The Chairman of the Scottish Advisory Council, Sir Patrick Dollan, recently expressed the hope that the total of passengers carried annually in Scotland would rise to 300,000 within the next three years; last year it was 150,000. Present traffic trends indicate that this may well be the case.

* * *

On Wednesday, August 22nd, B.O.A.C. made two charter flights with servicemen, one to carry 40 R.A.F. personnel from London Airport to Livingstone and the other to transfer 40 members of the Burmese Air Force from Rangoon to the United Kingdom. Although the Corporation recently announced the cancellation of charter flights through India and Pakistan because of the fuel situation, the two governments concerned are reported to have made special arrangements to supply fuel for these flights.

* * *

An operating profit of about £250,000 was realized by B.O.A.C. in the first quarter of the current financial year. About £200,000 of this sum was made in July, when revenue reached a record figure of £2,873,000. In the twelve months ended February 28th, the corporation's operating deficit was £3,140,000 compared with £6,260,000 in the previous twelve months. The annual operating results of B.O.A.C. and B.E.A. for the year ended March 31st were announced last Wednesday (see p. 242).

* * *

Pressure of work on the new Berlin Airlift is continuing, but additional aircraft do not seem to be required at the present time. Only one British-owned Tudor is operating into the British sector; it makes several round trips daily between Berlin and Hamburg and carries an average of 50 tons per day. Manifests show a wide range of cargo, from heavy machinery to jam. To facilitate the reception and delivery of cargoes in Hamburg, a separate company has been formed; it is composed of a group of Hamburg air-freight forwarding agents.

EVERY WAVE FAMILIAR: At the end of a transatlantic flight last week, Eng. Off. E. D. Gilbertson of B.O.A.C. became the first aircrew member of the Corporation to have crossed the North Atlantic 350 times. Before joining B.O.A.C. in 1942 Eng. Off. Gilbertson served as a flight engineer with Coastal Command.

The Australian Government has approved the expenditure of £A690,000 to build a modern landing-strip on the Cocos Islands and to provide facilities for a regular service between Australia and South Africa. An R.A.A.F. works squadron, comprising 500 personnel, will begin work within the next few weeks. The existing runway of perforated steel plate is to be replaced by 8,000ft of crushed coral. A marine base for air/sea rescue launches is also planned. Q.E.A. hope that it will be possible to start a regular passenger service by March, the proposed route being from Perth to Johannesburg, *via* the Cocos Islands and Mauritius.

EXETER'S FESTIVAL AIR DISPLAY

IT was most encouraging for all who believe in the importance of airmindedness in this country, and its furtherance through the efforts of civil aviation groups, to see such an excellent turnout at Exeter Airport last week-end. It was particularly well-deserved encouragement in the case of the organizers, who, in spite of the threatening, blustery weather, were to be heard after lunch reporting to each other, "The roads are stiff with traffic." In fact, very little rain fell on the airfield during the afternoon, although storms were to be seen all round, and the 15,000 spectators, having sorted themselves out at the gates, found plenty to entertain them.

Both the R.A.F. and the Navy gave excellent support to the programme, although we failed to detect anything of a secret nature which might have justified the ban on photography by the R.A.F. There were Tiger Moths, Ansons, and even a Beaufighter, together with some visiting Vampires and Meteors; but perhaps the Chrislea hangar on the north side is about to bring forth a delta Super Jeep. (Photography is to be allowed at Farnborough).

This year the flying programme was deservedly the subject of favourable comment all round. There was never an unnecessary moment of delay, in spite of anything but ideal weather, and so anxious to be punctual were the performers, that the Mayor, Alderman F. P. Cottey (who arrived in a Bristol helicopter, with Mr. Hosegood at the controls) had to compete with a well-executed demonstration by No. 84 A.T.C. Gliding School as he delivered his last few opening words. Not one of the 17 events can fairly be omitted from this necessarily brief account; in rather telegraphic form, therefore, we report: The gliding was pleasing; the pupil-and-instructor act was well up to standard; S/L. Miller's crazy flying in a No. 12 R.F.S. Tiger was among the dicy-ist we have witnessed; a No. 10 R.F.S. turn—tied Tiger formation flying—was executed in a very creditable manner; S/L. Turner's Chipmunk aerobatics were smooth; the fly-past demonstration of aircraft-speed increase over 20 years (Tiger, Anson, Beaufighter, Spitfire) was original and well co-ordinated; F/L. R. E. Morgan's Vampire demonstration (No. 614 Squadron, R.Aux.A.F., Llandow) was as good as could be expected, a bad spell of weather joining in at the time; No. 1832 R.N.V.R. (A) Squadron's mock attack with their Seafires from Culham was lively and their formation good; No. 662 A.O.P. Squadron (represented by Capt. J. Elston and his Auster) co-operating with Royal Devon Yeomanry Artillery (T.A.) gave a dramatic demonstration of target location and gunfire-direction by aircraft; the Bristol Sycamore pirouetted, climbed, and slid in a quite graceful manner; three members of the remarkable Patrouille d'Etampes were present (pilots Lt. Kerguelen, Adjutant Charollais, and Sgt. D'Hulst) and though bounced around unmercifully by the increasing wind, managed most of their fascinating repertoire, though with a full outside loop in formation added and rather less inverted flying than usual; Sea Vampires of 702 R.N. Squadron (Culdrose) pleased everyone with their formation aerobatics; No. 809 R.N. Squadron gave a really spirited low-level attack in their Sea Hornets; Exeter C.A.A.C.U. Spitfires also raced round at low level to exercise the guns and gunners of No. 256 L.A.A. Regiment R.A. (T.A.); F/L. Latham from 614 Squadron, R.Aux.A.F., did very well on his Meteor solo; and, finally, defying the elements' worst of the afternoon, including a wind gusting to 25 knots, two Apex group parachutists courageously leaped at low level—one nevertheless managing a few seconds' delay drop—and in spite of a great deal of "allowance," both sailed rapidly over the northern airfield boundary into the wooded hills beyond Happily, a collar-bone injury sustained by Johnny Ralling on landing is not very serious.

Exeter's Air Day ended with a dance organized by the Club.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

S. of S. in Canada

MR. ARTHUR HENDERSON, Secretary of State for Air, arrived in Ottawa on August 24th on a week's visit to Canada to check progress of British pilots and navigators under training there. An augmented training plan is believed to be under consideration. Before he left London Mr. Henderson said that there were at present 350 cadets in Canada, and altogether 700 would be trained this year. The S. of S. is to visit both the Canadair and Avro Canada plants and may discuss with the Cabinet Defence Committee the possibility of Canada's building airframes for the R.A.F.

Cost of "Eagle"

IN evidence given before the Select Committee on Government Dockyard Estimates, it has been stated that the 36,000-ton aircraft carrier, H.M.S. *Eagle*, will cost £14,137,000, without guns. H.M.S. *Eagle* was launched at Belfast by Princess Elizabeth in 1946 and is expected to commission later this year from Devonport. Her war complement will include 100 aircraft and 2,750 officers and men.

Coastal Competitions

THE first competition among squadrons of R.A.F. Coastal Command for the Aird Whyte Challenge Trophy for air gunnery and bombing is being held at the Fowey bombing range, Cornwall, from August 30th to September 4th. The competition is open to all landplane and flying-boat squadrons of the Command. Squadrons will attack a waterborne moving target with front guns and will drop bombs. Nos. 203 and 210 Squadrons, flying Lancasters, are competing on August 30th, 31st and September 1st, and the Sunderlands of Nos. 201 and 230 Squadrons on September 3rd and 4th. Two senior officers of Headquarters, Coastal Command, are the judges and the referee is Air Marshal A. C. Stevens, C.B., A.O.C.-in-C., Coastal Command.

The trophy—a two-handled silver bowl—was presented to the Command in June by Mr. and Mrs. G. Aird Whyte in memory of their son, Sgt. N. F. Aird Whyte, an air gunner, who was killed while flying on operations in Coastal Command in 1943. It will be handed by the donors to the winning squadron at a date yet to be arranged.

Another new trophy, the Coastal Command Squadron Trophy, presented by the Coastal Command Officers' Reunion Dinner Club, is also being competed for this year for the first time. The trophy is for airmanship and the conditions of its award may vary from year to year. This year it is being awarded to the squadron with the highest percentage of instrument ratings combined with the lowest accident rate. It will be presented to the winning squadron at the annual dinner of the club at the Connaught Rooms, London, on September 7th.

EXERCISING IN MALTA: Twenty-eight R.Aux.A.F. airmen and airwomen were flown to Malta to augment the R.A.F.'s fighter control organization for the recent N.A.T.O. exercise. Seen on the job in this picture are, from front to rear, Sgt. D. V. Freeman, L. A/C. J. M. Pope and F/L. G. R. Adams. Standing on the right is Sgt. J. E. Mabey, and in the background, seated, are (left) Cpl. R. S. G. Shaw and (right) S. A/C. P. J. Thubron, a regular stationed in Malta.

Moral Leadership Reunion

A REUNION service for present and former members of the Royal Air Force and the Royal Navy who have attended Church of England Moral Leadership Courses during their time in the Services will be held at St. Martin's-in-the-Fields, Trafalgar Square, London, at 3 p.m. on Saturday, September 22nd. The preacher will be the Bishop of Willesden.

1833 Squadron for Holland

NO. 1833 R.N.V.R. Squadron, stationed at Bramcote, near Birmingham, will undertake a week-end flight to the Royal Netherlands Air Station at Valkenburg, Holland. Eight officers and four ratings, led by Lt. Cdr. R. F. Hallam, R.N.V.R., will embark in six Seafires and one Anson on September 28th and will return two days later.

Paratroopers Honour "Triumph"

OFFICERS of the 16th Independent Parachute Brigade presented a silver salver to the aircraft carrier H.M.S. *Triumph* at Portsmouth on August 15th. The salver bears the figure of a paratrooper in full kit, and the gift was made to the ship in appreciation of the hospitality shown by her officers and men to the brigade when the *Triumph* took them from Portsmouth to Cyprus early in June.

Navy Recruits Observers

THE Admiralty announce that the scheme whereby former Naval pilots not above 33 years of age may now apply to re-enter the Navy in flying appointments has been revised to include observers, and to provide that the appointments may now be for a period of four years or for longer periods up to eight years according to age. These periods would be followed by varying periods of reserve service on the Emergency List up to a maximum of seven years for those serving eight years on the Active List. The engagement carries a tax-free gratuity of £1,500 for those who undertake to serve for eight years at the outset and at the rate of £175 per annum tax free for shorter periods, e.g. £700 after four years. This is the newest example of the steps the Admiralty is taking to meet its requirements of officers to fly.

Battle of Britain "At Homes"

THREE-QUARTERS of a million people are expected to attend this year's Battle of Britain Week At Homes at 66 R.A.F. stations on Saturday, September 15th. Fighter Command is opening more than a dozen stations and Flying Training Command are inviting the public to sixteen. There will be no charge for admission, but proceeds from car parks, programme sales and other activities will be shared by the R.A.F. Benevolent Fund and the Royal Air Forces Association, which last year received a total of £13,625 from At Homes. British Railways will again issue cheap-day tickets to railway stations near the airfields concerned from points within a 30-mile radius.

Following are the R.A.F. airfields to be opened. Where towns or cities are affiliated to these stations they are shown in parentheses.

Valley; Cardington (Bedford), Henlow (Hitchin), Abingdon (Oxford), Halton (Aylesbury), Waterbeach (Cambridge), Hawarden; Hooton Park; St. Eval (Newquay), Mount Batten (Plymouth), Debden (Saffron Walden), Hornchurch (Romford and Hornchurch), North Weald; Chigwell; Leuchars (Dundee), St. Athan (Cardiff), Filton; Little Rissington (Cheltenham), Aston Down; South Cerney (Cirencester), Thorney Island (Portsmouth), Andover (Andover), Upwood (Peterborough), Dalcross; West Malling (Maidstone), Biggin Hill; Hawkinge (Folkestone), Woodvale; West Kirby (Birkenhead), Kirkham (Preston), Weeton (Blackpool), Cranwell (Sleaford), Manby (Louth), Binbrook (Grimsby), Hemswell (Gainsborough), Scampton; Coningsby (Boston), Hendon (Hendon), Kinloss (Elgin, Forres and Nairn), Feltwell (Thetford), Coltishall (Norwich), Watton; Aclington (Newcastle-on-Tyne), Newton; Benson (Reading), Pembroke Dock; Cottesmore (Oakham), Ternhill (Newcastle-under-Lyme), Shawbury (Shrewsbury), Bridgnorth (Bridgnorth), Cosford (Wolverhampton), Felixstowe; Castle Bromwich (Birmingham), West Freugh; Melksham (Melksham), Hullavington (Chippenham), Colerne (Bath), Church Fenton (Leeds), Yeadon; Linton-on-Ouse (York), Catterick (Richmond), Leconfield (Kingston-upon-Hull and Beverley), Dishforth (Harrogate), Middleton St. George (Darlington), Thornaby; Jurby

AN AMERICAN IN CANADA: The Royal Canadian Air Force is placing in service a number of Lockheed T-33 two-seat jet trainers, developed from the F-80 Shooting Star fighter. Illustrated is one of the first of these handsome tandem-seaters.

Service Art

THE R.A.F. has been invited by the Army Art Society to take part in the society's exhibition at the Imperial Institute, South Kensington, London, from November 14th to 29th. The receiving day will be November 1st. Particulars may be obtained from the Secretary, Army Art Society, 98, Piccadilly, London, W.1.

R.A.F. Aeromodelling

THE finals of the Royal Air Force Model Aircraft Association's competition this year will be held at R.A.F. Station, Coningsby, Lincs (the most central airfield available) on September 1st and 2nd. Members are to assemble this evening, August 31st, and contest flying will start at noon the following day. Events will include duration tests by models powered with miniature diesel and jet units as well as rubber-driven aircraft and gliders. There will be speed tests and team-racing events. Other spectacular contests will be aerobatics and flights—including take-off and landings—by radio-controlled models. A *concours d'elegance* will also be held in which finish, workmanship and detail will gain the winning points.

The President of the Association is Air Chief Marshal Sir Hugh P. Lloyd, Air Officer Commanding-in-Chief, Bomber Command. All stations throughout the R.A.F. are encouraged to form clubs, membership of which is limited to serving personnel of the R.A.F., W.R.A.F., and members of other Armed Forces on the posted strength of a R.A.F. station. This is another R.A.F. activity in which U.S.A.F. personnel may—and do—take part.

R.A.F. Horticultural Show

THE ninth annual Royal Air Force Horticultural Show, in the Royal Horticultural Society's Old Hall in Vincent Square, Westminster, on September 18th and 19th, will be opened at 3.30 p.m. on the first day by Mrs. Attlee. Open to all R.A.F. stations maintaining unit farms or gardens for the benefit of messes, the show is held to encourage units to grow food of better quality and greater variety and in sufficient quantity for their needs. There will be 32 classes for vegetables, six for fruit, and four for flowers. Trophies to be competed for are the Royal Horticultural Society's challenge cup, the R.A.F. horticultural challenge trophy, and the R.A.F. horticultural trophies for fruit and flowers. In addition, the unit garden trophy will be presented to the winning station. Mrs. Attlee will present the prizes. There is keen competition among the Commands and R.A.F. stations. Last year there was a record of 849 entries. Such well-known horticulturists as Messrs. W. L. Lavender, J. S. Cracknell, W. F. Giles, F. Streeter, P. E. Tomalin and F. G. Potter will judge the vegetables and fruit this year, while the flowers will be judged by Dr. A. G. Erith and Miss Hole, of the Department of Agricultural Botany at the University of Reading. The show will be open to the public from 5 to 7 p.m. on September 18th and from midday to 6 p.m. on September 19th.

Each R.A.F. Command at home is now responsible for the organization of the show for two years. Bomber Command, which organized it last year, is organizing it again this year and the president of the committee is Air Chief Marshal Sir Hugh P. Lloyd, the Air Officer Commanding-in-Chief. The chairman is G/C. A. H. Fear. In 1952 and 1953 the organization will be the responsibility of Fighter Command.

Unit Badges

AMONG a number of Royal Air Force unit badges recently approved by the King are those for R.A.F. Station, Driffield, Yorks; No. 109 Maintenance Unit; No. 663 Squadron, R.Aux.A.F.; and No. 3506 (County of Northampton) Fighter Control Unit, R.Aux.A.F.

The badge for R.A.F. Station, Driffield, depicts a marine shell in front of a York rose. The shell is part of the Crest of the Sykes family, on whose land the airfield is situated. "Strong foundations" is the motto.

No. 663 Squadron is an Air Observation Post squadron at Hooton Park, Cheshire, and the nature of its work is explained by the motto beneath the badge: "We fly for the guns." The unit was formed in Italy with Polish personnel in September, 1944, and the badge is a Polish eagle holding a snaffle bit, the bit symbolizing the control exercised over the artillery formations for which the squadron operates.

The badge for No. 109 Maintenance Unit is a gear wheel in front of a flash of lightning, the gear wheel indicating the unit's functions, which consist of the inspection and repair of aircraft, and the flash of lightning symbolizing the electrical and radar trades with which the unit is concerned. The motto is "Manus artificis aquilas alunt," which may be translated as "The hands of the craftsman feed the eagles."

A lion rampant in front of a fetterlock is depicted in the badge for No. 3506 (County of Northampton) F.C.U. These heraldic devices have local associations, the lion appearing in the armorial bearings of the town of Northampton and the fetterlock in those of the county. The fetterlock denotes the control which the unit exercises over aircraft, whose strength is symbolized by the lion. The motto beneath the badge is "Direct to kill."

Middle East Swimming

A 19-YEAR-OLD National Serviceman, A/C. K. Bentley, now serving in the Middle East Air Force, recently put up the finest long-distance swimming performance ever given by R.A.F. servicemen in the Suez Canal Zone. As captain of a six-man team from the R.A.F. Station at Kasfareet he covered a seven-and-a-half-mile course across the Great Bitter Lake from the Sinai Desert shore to the finishing point near Fayid in 4 hours 13 minutes, beating all other times established either by the British Army or the R.A.F. for the same distance. The occasion was the first R.A.F. Egypt Inter-Station Cross-Lake Swimming Championship, in which swimmers from six Canal Zone R.A.F. stations competed for a cup offered for annual competition by R.A.F. Station, Abyad.

Twenty-two of the 26 R.A.F. swimmers who started completed the course. A/C. Bentley was the individual winner and R.A.F. Station, Kasfareet, in bringing home the first four men, won the trophy.

Invitation for Parents

AN innovation at the R.A.F. No. 13 School of Recruit Training at R.A.F. Station, Innsworth, Glos., is the weekly passing-out parade, to which parents and relatives of the recruits concerned are invited and afterwards shown round the station. Also on the station is the R.A.F. No. 2 School of Cookery and the food factory run by the school, which produces cakes, scones, rolls, cold hams, pressed beef, sausages, etc., for the recruits. Visitors have said they are much impressed by the factory and by the hygienic conditions under which the food is produced.

Reunions

THE fifth annual reunion of Nos. 34 and 113 Squadrons, R.A.F., will be held in London on October 13th. All details from E. E. Kennington, Trenderway, Pelynt, Looe, Cornwall.

No. 136 Squadron is holding a reunion at The Peacock, Maiden Lane, Strand, W.C.2, at 7 p.m. on October 27th. Tickets (10s.) from S/L. V. K. Jacobs, Air Ministry, O.8, Bush House, S.E. Wing, Strand, W.C.2.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Hurricane Warpaint

I HAVE been very interested in your correspondents' letters concerning surviving Hurricanes. Mr. R. P. Bateson has raked up some particularly interesting historical data in his, but slipped up when he wrote that *Last of the Many* was originally finished in light blue with a red spinner.

I was working in the D.O. at Langley when the last Hurri passed through the shops with mixed weeping, gnashing of teeth and festivities! As you will see in the enclosed photographs, it was painted in the then popular "sand and spinach" desert camouflage (with light blue undersurface and yellow leading edges) and carried the unusual load, even for the versatile Hurri, of a large banner recalling many of the victories of this grand aircraft. The pictures are by permission of Hawker Aircraft, Ltd.

Hayes, Middlesex. J. W. R. TAYLOR.

A fine impression of the historic Hurricane, "Last of the Many", with Maj. P. W. S. Bulman at the controls. (See letter from Mr. J. W. R. Taylor).

Can Fishes Fly?

I READ with interest Mr. L. W. Crawford's note (July 27th) as I, too, have spent many hours observing flying fish in flight. Perhaps the following notes may be of interest.

(1) The wing plan-form is remarkably like that of the early Spitfire in proportions. This suggests "powered" flight rather than gliding flight, for which a seagull or albatross wing plan-form would be expected.

(2) After "take-off," the flying fish passes over wave-crests and troughs (rather than along them), apparently taking advantage of upward air currents. Seagulls do this and remain airborne indefinitely, but the flying fish cannot, and, eventually, reaches stalling incidence.

(3) In this attitude, his vertical tail-fin, which extends below the body for a few inches, contacts the water. The fish now "wiggles" violently, using his fin as a fisherman uses a single oar for "sculling" over the stern of his boat. A large gain in speed results, and a track is left in the water.

(4) At the same time the wings do vibrate, but hitherto I had assumed that this was merely to counterbalance the "wiggling" action of the tail (*c.f.*, the swinging of a man's arms when walking). But I see no reason why this vibration of the wings should not assist in propulsion; I cannot imagine Nature having overlooked this possibility.

The "Last of the Many" leaves the shops with fitting farewell decorations.

(5) The normal flight of the fish is always near the water, alternately gliding and "wiggling." It is conceivable that with an extra hard "wiggle" ("giving her ten") and by making use of the eddy (air) currents round a ship's hull the fish would be able to climb aboard "into the frying-pan"!

(6) He does not appear to be able to vibrate his wings while his tail is clear of the water—at least, not with the same amplitude, so that I am not fully convinced that he can sustain flight indefinitely.

But what I have not been able to discover is just what he does when he belly-flops. It is a strangely awkward action to finish an extremely graceful flight. Can it be that he sets his wings in sub-marine trim while still airborne? He certainly does not use them as a parachute, as biology would have him do!

Purley, Surrey. P. A. V. DOLLEYMORE.

CAN fishes fly? Having read all that L. W. Crawford has to say on the subject, I am still unconvinced. The question is: do the pectoral fins flap by the buffeting of the wind, or are they purposely moved to aid flight?

Flying fish have been observed traversing distances of 200 to 300 yd above water and in some instances have been known to land on the decks of ships, but the muscles of the pectoral fins, on inspection, lead one to suppose that these are too weak to produce the extreme movement necessary to sustain flight.

The initial impetus of movement out of the water is given by the tail-lash of the fish, and at certain intervals the fish descends to the water surface and is further propelled forward by another tail-lash. This bears out Mr. Crawford's description of a "vertically sinuous flight-path, rising and descending to clear wavelets." Variation of lash would produce slight changes in direction and thus account for the "small and erratic turns."

London, E.C.3. W. LAWSON.

Aircraft Fires

IT is common gossip that there is no recorded instance of the fire-fighting appliances being instrumental in the saving of human life after a crash on a civil airfield in the last 20 years, though obviously this was not the case on Service airfields during the war, when in many instances the fire brigade was "all set" to receive a lame duck.

In view of the enormous amount of money that is already being spent on airfield fire services, and rumours that there is likely soon to be a substantial increase in the equipment required for even the most small and unimportant fields, it would be enlightening if any of your readers could confirm the truth or otherwise of the above widely held belief.

In view of the rapidity with which a petrol fire spreads (if it is going to) and the extreme difficulty even the most elaborate appliances experience in putting out aircraft fires after the occupants are obviously dead, it would, indeed, be surprising if there are such instances, apart from the fact that "prangs" have a tendency to occur outside the perimeter, where the fire engine cannot, in any case, get at them.

London, E.C.3. ENQUIRER.

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HORACE, our Tame Stressman, has been indulging in the unforgivable sin of melancholic retrospect! Looking back through the advertisements of this firm for the past twenty years has brought back memories . . . memories of the days before Aviation became a vast bureaucratic octopus with all its tentacles tied in bowlines. Everybody knew everybody in those days and there was a press-on spirit. The weather was very much better and people used to die of sunstroke. We could play cricket in May without gum-boots and something like ? ? ? Moths teetered about the skies of Britain. We could buy ten good cigarettes for sixpence, a hot lunch for one shilling, and a pint of beer for fourpence. The slot machines were in working order! From this delving into the past a few small incidents have sprung to memory with nostalgic poignancy. We recall these now as a reminder of the services given to aviators then and still available for the asking now.

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4. WE bought the Fox Moth on floats from the late Aymill Antarctic Expedition and sent it to the Tropics.
5. WE thought we had sold a Tiger Moth to "Colonel" Neville Heath!
6. A client of ours was the first non-smoking pilot to fly a Tipsy Trainer over Helsinki.
7. WE sold a Dragon to Eire which carried 233 souls on one St. Patrick's Day!
8. WE sold the first three Percival Q.6's to be delivered to clients.

HORACE, our Tame Stressman, returns with a shudder to 1951: Mr. Gromyko, no ground nuts, Persia, no beef, no Gambia poultry, Korea, 3/7 cigarettes, Mr. Gromyko. But there are a few bright spots: we sold our first aeroplanes to Madagascar and Fiji, 2 Short Solent Flying Boats to Australia, 2 Dakotas to B.O.A.C., three Doves to Bahrein, and New Guinea, etc.

SO let us keep pressing on!

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TUITION

A. S. T. HAMBLE is the world's Premier Civil Aeronautical Training Establishment. [0337

Here goes the first one

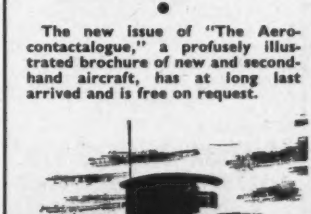
In this column on August 17th we announced the fact that another complete fleet, consisting of Rapides, Geminis and an Aerovan, had been placed exclusively in our hands for sale and now, lo and behold, we are able to publish the above photograph of the first of this fleet to leave our hangar bound for the very Far East. We agree that an aeroplane looks a trifle undignified on the back of a lorry, but by the time this column appears she will be neatly packed up and on her way.

We have already held forth on the technical excellence and trim appearance of every aircraft in this fleet, and it is not surprising to find that several potential purchasers are busily arranging Letters of Credit and other forms of finance, but, as yet, it is not too late for Rapide and Gemini fans to cash in on the best offer yet made in this particular sphere. Just to refresh the memory the Rapides are each priced at £1,500 with 12 months' or long-term Certificates of Airworthiness, and each machine has V.H.F. equipment, whilst three have C.B.A. with an M.F. receiver. One Gemini is priced at only £1,200 as the Certificate of Airworthiness has expired, though it has flown only 12 hours since C. of A. overhaul and 570 since new. The other is priced at £1,300 and has a C. of A. until February, 1952. STR 9 four-channel V.H.F. radio is installed. The Miles Aerovan is offered at £1,500 with a 12 months' Certificate of Airworthiness and is complete with four-channel V.H.F. equipment.

Genuine purchasers are earnestly requested to make a swift decision, as these machines are not expected to remain long on the market.

●

The new issue of "The Aerocontactalogue," a profusely illustrated brochure of new and second-hand aircraft, has at long last arrived and is free on request.



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DESIGNERS and senior and junior draughtsmen for work on gas turbine engines. Midland area. Experience not essential but an advantage.—Apply to Armstrong Siddeley Motors, Coventry. [0618]

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JIG and tool draughtsman required, fully experienced, —Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [0593]

JIG and tool draughtsmen required. Previous aircraft experience not essential. Pension and life assurance scheme.—Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6754]

WANTED, flight engineers for York aircraft. "A" and "C" to cover York aircraft essential.—Apply: Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0610]

LICENCED radio engineer for Dakota aircraft. Good pay and conditions. Apply, Mr. Adams, Scottish Airlines, Northolt Airport, Ruislip, Middlesex. Tel.: Waxlow 4311, ext. 427. [6847]

APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

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ENGLISH ELECTRIC invites applications from suitably experienced draughtsmen for aircraft work at Warton or in London. Men interested in these Government positions should write, quoting Ref. 120F, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham Street, London, S.W.1. [6931]

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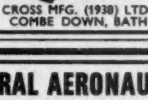

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